ECONOMIC AND SOCIAL IMPACTS OF THE NORTH AMERICAN FREE TRADE AGREEMENT IN TLAXCALA, MEXICO

By

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PREFACE

This study was conducted to provide new knowledge on the impacts of globalization on the subsistence producer, household, and community. This was achieved specifically through an evaluation of NAFTA's impacts on five rural villages in the state of Tlaxcala, Mexico. Tlaxcala was chosen due to its relatively high level of industrial activity resulting from its proximity to the large consumer market of Mexico City and the seaport of Veracruz. This combined with its widespread, predominantly peasant agricultural base provide the perfect background against which to analyze the effects of globalization upon the interaction of the subsistence producer with the wider economy

I would like to offer my sincerest gratitude to the members of my committee – Drs. Shida Rastegari Henneberry (Chair), Emma Zapata Martelo, Veronica Vazquez García, Derrell Peel, and David Henneberry – for their assistance and suggestions in the completion of this research. I would also like to thank residents of the communities of Emiliano Zapata, Lázaro Cárdenas, Santa Fe la Troje, Capula, and Zotoluca for their time, trust, and unending patience. Without them, this research would not have been possible. In specific I would like to thank Emilio Palafox of the Zapata Agricultural Commision, Lic. Alma Inés Zamora Gracia with the Xicohténcatl Industrial Corridor, and Martín of the Cárdenas Delegacion for their extraordinary contributions I would also like to thank the OSU Department of Agricultural Economics, the Ford Foundation, and Conoco for project funding. Lastly, I would like to thank my husband John and my son Dustin for the

incredible sacrifices they made, for their willingness to share their wife and mother, and for their love, which was all I ever needed to keep going. I would like to express my hope that the knowledge gained from this project will contribute to the just and equitable advancement of our world, and will justify the efforts made on the part of all these peoples.

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VOCABULARY

abañil: laborer, construction-worker.

abono: fertilizer

avena: oats

barbecho: preliminary tilling

betabel: turnip

campesino(a): peasant

campo: fields or agricultural areas.

cebada: barley

cerro: hill

ciudad industrial: industrial city, or corridor

ejido: community land distribution and ownership program and structure.

frijol: beans

fabrica: factory

haba: broad-bean

hombre: man

maguey: large succulent of the agave family used for agricultural purposes.

monte: hill or mountain

mujer: woman

maíz: corn

prepa: high school

primaria: elementary school

pulque: fermented beverage from maguey nectar.

riego: irrigation

secondaria: middle school

taller: workshop

temporal: rain fed agriculture

zacate: dried corn stalk forage

NOTE: These definitions provide a basic understanding of vocabulary used repeatedly throughout the text. More detailed translations are provided as footnotes where necessary. These works are only roughly translated to facilitate the readers understanding. They are *not* exact translations.

1. INTRODUCTION

Throughout Mexico, the agricultural sector has traditionally played a principal role in the rural economy. However, in recent years, many macro-economic and policy variables have shifted, resulting in structural changes in the labor distribution of these areas. One of these changes has been the initiation of the North American Free Trade Agreement (NAFTA), which has greatly diminished, and in some cases eliminated, policy induced trade barriers between Canada, the United States, and Mexico. The North American Free Trade Agreement, which was signed in December of 1992 and went into effect in 1994, is the most extensive free trade agreement short of a common market ever negotiated and is unique in its inclusion of both developing (Mexico) and industrial (Canada and U.S.) nations.

This agreement is the first of its kind between nations with such extensive cultural, social and economic differences, and many fears have been expressed on the part of all countries involved as to the outcome of this integration. Mexico has feared that its small proprietorships, manufacturers, and agriculturists will be unable to compete against the large American and Canadian firms with their seemingly unlimited access to capital and ability to exploit existing economies of scale (Barajas, 1993). American politicians and public alike have voiced the fear that the American unskilled worker will not be able to compete against the Mexican *mano de obra* with the Mexican minimum wage averaging approximately $3.00 U.S. per day, or 7% of that which must be paid to an American worker of an equivalent skill level. In addition, Canada has expressed uncertainty on how this agreement will affect many of its traditionally subsidized and

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protected employment and production sectors, and the possible conflicts with its historically more socialistic policy approaches.

This agreement is unique not only in the diverseness of its participants, but also in its inclusion of agricultural products. The agricultural sector has a long history of exclusion from major trade agreements due to national food security issues. The ability to feed one's own people is one of the most basic needs a country faces, and becoming entirely or overly dependent on an outside source to meet this need has the potential to develop into a politically sensitive situation. This political concern combined with desires to protect the agricultural sector for a variety of other economic and cultural reasons has resulted that agricultural products have either been excluded entirely from past free trade agreements, or treated very gingerly with no great reductions in the true levels of protection.

While the agricultural sector is included in the NAFTA agreement, it does hold a unique position in that two separate bilateral agreements were negotiated versus one single trilateral agreement. The agreement phases out existing tariffs over a 10-year period, and also alters the previous agricultural trade restrictions into tariff-rate quotas, and then over a 10 to 15 year period phases out the over-quota tariffs. This latter method applies principally to import sensitive products, and includes a majority of the crops produced by Mexico's subsistence farmers. These crops include corn, beans, and barley -- which have the following quota system for Mexican import: 2.5 mil. MT (US) and 1000 MT (Can), 50000 MT (US) and 1500 MT (Can), and 120000 MT (US) and 30000 MT (Can) respectively, and the following over-quota tariffs: 215%, 139%, and 128%

respectively (Hufbauer, 1993). Over the first six years this tariff will be reduced by 24% of its base level, and the remaining tariff is then phased out in equal annual reductions.

These changes in agricultural trade policy, coupled with other changes in the economic environment resulting from this trade agreement such as changes in industrial demand for labor and changing input costs, have the potential to greatly impact rural communities throughout Mexico. With 23 percent of Mexico's population functioning in the agricultural sector, any impacts in this area will have widespread implication. This sector of the population is also the sector least able to survive any negative repercussions with the GDP per capita in rural areas averaging slightly less than one fourth that of urban residents. (SARH, p. 13).

Due to this vulnerability of the rural sector, the possible effect of NAFTA's tariff reduction has been the subject of widespread controversy. The popular press has helped spread fears that the Mexican producer will no longer be able to compete in a expanded market which includes competition from both U.S. and Canadian producers. Barajas (1993) has compared the current process of tariff reduction to the trade liberalization process enacted among basic grains in the 1980's which resulted in a sharp increase in the quantity of these commodities imported from U.S. producers. This has been taken to indicate that without trade barriers, the Mexican producer is non-competitive due to his inability to produce these commodities at the same price as his northern competitors. This has been attributed to factors such as economies of scale, limited access to credit and technology, and reliance on traditional production practices.

In such a production environment, the enaction of NAFTA trade liberalizations would have negative implications for the viability of the Mexican agricultural sector and

rural community as a whole. As small farmers are forced off their land due to falling prices, increased rural-urban migration would result, further undermining the rural community. However, such a scenario ignores vital aspects of the Mexican production system. In 1991, 34% of all agricultural land holdings in Mexico consisted of 'minifundidos' or small holdings of less than two hectares (OECD, p36). These holdings are farmed principally by subsistence level producers, whose production never enters the formal marketplace. An additional 17% of landholders have access to between 2 and 5 hectares (OECD) and while the majority of these do not fall under the heading of subsistence farmers, they can be classified as only semi-commercial. In this case it is only that production in excess of the family's consumption requirements which is put up for sale.

Together these two groups account for 51% of Mexican farm enterprises, indicating that a large portion of the agricultural enterprises are either entirely insulated from the formal marketplace, or are only marginally participating. It is also interesting to note, that due to their subsistence or semi-commercial nature, those producers which are excluded from the formal market are also the poorest producers. Due to this marginal interaction of the resource scarce portion of the rural population with the formal market, it is hypothesized in this study that the price impacts of NAFTA on the agricultural community will be minimal. Increased competition from foreign producers providing these commodities at a lower price should not affect the economic viability of a producer whose product never enters the market.

However, price effects are not the only manner in which NAFTA threatens to alter the rural community. Even if production is unaffected by prices, the growing

presence of industrial corridors throughout Mexico and the changing demand for labor can draw upon rural labor pools, changing not only the distribution of labor in the agricultural sector but also providing an alternative work environment of questionable quality.

It is also important to note that the social impacts of NAFTA on the rural community by way of labor restructuring are not expected to influence all household members equally. Due to varying economic activities and labor distributions, the effects are expected to vary by age and gender. Many works have hypothesized that trade liberalization presents a more distinct threat to peasant women due to various reasons including but not limited to:

1) The female's need to compensate for absent male labor as men emigrate in search of opportunities in other sectors when the agricultural sector becomes non-viable with increased competition,
2) The existence of trends towards double-duty, in which women tend to take on additional work in the non-agricultural sector to supplement the family income, yet continue with all their previous household, familial and production responsibilities at their previous level, resulting in a dramatic increase in the female workload, and
3) The poor work conditions present in factories utilizing primarily unskilled female labor.

Despite these negative repercussions, which have the ability to prejudice the process of liberalization against the female gender, researchers have found in some cases that this process can actually better the position of the rural women. This betterment is principally

due to her increased access to her own resources as a result of her interaction with the formal market, and secondarily as a result of augmentation in overall family income. While the gender biases of trade liberalization may be uncertain, it is obvious that excluding gender from a study proposing to evaluate this process would be inappropriate, and such an attempt could not accurately evaluate the impacts of trade liberalization on the community as a whole.

Whether effecting traditional gender relations, labor distributions, agricultural practices, or cultural and political activities, it is obvious that the process of trade liberalization has the ability to impact the rural community on a variety of levels. A comprehensive evaluation of NAFTA's impact on the rural sector (by way of both price effects and changing industrial labor demands) is necessary to indicate in which manners this policy is affecting peasant welfare and production systems, and to help indicate any areas which might ease this transition to free trade for those people most at risk. In addressing this need, the general objective of this study is to increase knowledge over the impact of the North American Free Trade Agreement on the interaction between the agricultural and industrial sectors on the regional and household levels. The specific objective is to determine the economic and social impact of the North American Free Trade Agreement on rural individuals and communities in the Xicohténcatl industrial corridor region of Tlaxcala, Mexico.

Tlaxcala was chosen for this research due to its traditionally high level of industrialization, which has stemmed from its advantageous location between the large markets of Mexico City and the seaport of Veracruz. While its economy is principally agricultural, its history of industrial activity has provided it with features such as

infrastructure, and skilled labor, which make it particularly attractive to the myriad of industries considering Mexico for the location of facilities in the wake of NAFTA. In addition, the central location of the state within the Republic and isolated nature of many of the villages in the newly formed industrial corridors, leave many agricultural producers and communities somewhat virginal with respect to their exposure to industrial culture and outside influences. This is a characteristic somewhat less common among the industrial zones along the northern border of the country. This blossoming interaction between the peasant agricultural sector and the rapidly expanding industrial sector make this state the perfect stage for analyzing NAFTA's impact on the agricultural - industrial relationship present in these communities.

With the area chosen, the research objectives were accomplished by way of a three-stage study, which consisted of: 1) evaluation of industrial response to NAFTA with respect to labor requirements and estimated agricultural price changes. 2) A linear programming farm production model to indicate how farm production strategy, resource and labor allocation will respond to NAFTA induced commodity price and industrial changes. 3) A social evaluation of the impact on the lives of the families effected, to be gathered from personal interviews.

While the principal contribution of this work was the holistic evaluation of NAFTA upon a community at all levels, social and economic, the research presented some challenges which required creative solutions. In turn, the solutions themselves formed their own contributions to the current body of literature with respect to mathematical modeling of household and community production systems. The model developed for this study was unique in its inclusion of unpaid female labor activities

(such as household management, child-raising, food-preparation and collection) as a restraint within the activity column. This forced the women's contribution to be included in the final outcome, despite the lack of monetary value. This avoided the devaluation of unpaid labor which typically occurs in this type of model, and provided an important first step to accurately evaluating the policy impacts of NAFTA upon the entire household and community, not just those whose labor is compensated monetarily. By including the often overlooked unpaid labor sector (which is normally preformed by women, elderly, children, and absolute poor), this population sector received equal weight in the evaluation. This type of approach, if more widely implemented, could result in more equitable policy evaluations that ceased to devalue these indispensable contributions.

In addition, natural resource endowments were considered in the modeling. Three principal groupings of production systems were evaluated as follows: 1) irrigated producers; 2) rainfed producers with moist soils; and 3) rainfed producers with arid soils. This last category was separated into large and small producers, as the size of the land allotment was expected to make a large difference in their decision making process. This study indicated that policy effects varied greatly across producers, disproportionately benefiting those with greater natural resource endowments.

The results of this study indicated that while falling commodity prices have harmed most families (excepting those on irrigated lands), the employment provided by increased industrialization has for this most part negated this impact and resulted in an overall increase in family income. This has occurred in large part in direct association with an augmentation in female workload, and has been associated with changing gender roles and community structures. Despite these changes, this process is seen as not only

congruent with the sustainability of the rural community, but as beneficial through its reduction of many risks associated with agricultural processes. However, it must be noted that this is achieved only by disproportionately burdening the women and youth of these communities.

These results, and the development of the research and models which allowed them are discussed in detail in later chapters. However, before addressing these issues, it is first necessary to evaluate the theories and academic precursors upon which they are based. A general review of the interaction between international trade and the development of the rural community is presented in the following chapter, *Theoretical Framework.* This chapter familiarizes the reader with the diverse ties that bind the rural community and individual with changes in the often far-separated global markets and trade process. The next chapters, *Economic and Political Frameworks* and *Regional Characteristics*, provide the reader with an understanding of the political, economic, social, and sectoral backgrounds of both Mexico in general and Tlaxcala in specific, thus providing a context for the research at hand. This is followed with *NAFTA and Mexican Agriculture* which evaluates NAFTA's impact on the social and economic facets of rural Mexico, as seen by prominent Mexican authors and academia. *Literature Review* then evaluates how previous researchers have analyzed this and other related issues, incorporate their methods, suggestions and observations, and justify the approach chosen for this project. *Methodology* then clearly lays out the approach chosen as most appropriate for this particular project and area, and the fully developed model is than presented in *Linear Programming Model.* The results are presented in detail in *Findings*, and are summarized in *Concluding Remarks.*

2. THEORETICAL FRAMEWORK

As global markets swell and the small steps towards freer trade begin to be taken across the face of the planet, a variety of questions have been raised. As small, previously isolated countries, communities, and producers increase their interaction with this ever shrinking world, it becomes obvious that change of some kind must be expected. The questions remain: what type of changes? to the benefit of whom? at what cost? This chapter attempts, if not to answer these questions, to evaluate and recognize them. While the answers may not exist, the understanding of the questions, and of the theories and hypothesis that spawn them, is a vital step which must be taken if ever there be hope of finding answers.

International trade has the ability to affect the rural community through a variety of venues. Its effects on economic and social development have extensive impacts on both the individual and community structure. While changing prices and competition can alter production structures, increasing outside influences tend to alter traditions and social structures. A changing industrial base and labor restructuring can affect not only immigration patterns, but also household structure and the viability of the rural community. In addition, the associated economic growth and development can present serious questions with respect to the quality of the rural environment and the returns to rural labor. Equity issues have been raised with respect to subsistence farmers, indigenous communities, and the role of women in this changing economic and social structure. The following sections evaluate some of the concerns with respect to these issues.

2.1 Structural Relations between International Trade and Development:

International trade's implications for the rural community run deep. From changing cultural identity and altering production practices, to the structural nature of economic growth, sectoral changes, and labor force adjustments associated with international trade, many facets must be evaluated. The concerns over international trade's relationship with sustainable development are extensive, and due to the ecological and equitable implications of this topic it has direct bearing on the rural community.

While international trade has long been associated with economic growth and increased efficiency within an economy, economic growth and development are two entirely different concepts. Economic growth indicates only an increase in the gross domestic product of a nation, whereas development indicates a change in the production structure to increase the standards of living of a nation's citizens. Even further separated is the notion of sustainable development, which has been defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987). While this definition has faced some criticism due to its vague definition of 'needs', it is the most widely used and accepted definition available.

Factors typically neglected in the development process, which have significant implications for sustainability, are the environment, poverty, and equity. A development process resulting in continuos environmental damages and degradation cannot be sustainable in a finite ecosystem such as that in which we live and function. However, these environmental limits are not the only requirements for a sustainable system. As stated in the Bruntland report, a physical sustainability within the environmental

framework cannot be achieved without appropriate considerations with respect to resource access and cost benefit distribution.

While international trade may result in a greater good than harm in the general area of 'development', its contributions to 'sustainable development' appear questionable. Concern over the effects of international trade on sustainable development is widespread, and the debate has been given extensive treatment in literature. Academia appears to agree that the devaluation of the environment and equity, while strongly linked to international trade issues, appears to be more rooted in the economic growth model from which spring the theoretical supports for free trade. This deep and inseparable connection between growth rhetoric, international trade, and non-sustainable development which hold such significant influence over the wellbeing of the rural community has been examined from many different angles. Despite its widespread and probing critiques, free trade theory proposes many benefits, which many nations are currently attempting to enjoy.

2.1.1 Free Trade Theory

Since David Ricardo's nineteenth century formulation of the Theory of Comparative Advantages, free trade has enjoyed an economic association with increased efficiency and consumption. The increased competition that is provided by a second nation in a free trade situation should pressure the first nation's economy into a restructuring phase, and vise versa. Inefficient sectors incapable of competition would be put out of business, causing its resources (labor, land and capital) to be shifted to more

efficient sectors (Carbaugh, 1995). This resulting increase in efficiency should allow the economy to produce a greater value of output with the same quantity of resources.

In addition to the efficiency argument, free trade has also been widely linked to economic growth. Jung and Marshall (1985) have presented basic associations between trade and GDP growth which consist of the following factors: a) as exports are a component in calculating GDP, in exports are increased, ceteris paribus, GDP must increase; b) the export sector might result in positive externalities, leading to increased GDP growth; and c) exports result in an influx of foreign exchange, relieving any possible foreign exchange shortages, thus allowing the economy to import any needed capital goods and facilitating growth.

While these relations with increased efficiency and faster economic growth have traditionally resulted in a favorable policy approach towards international trade, there still remain doubts as to its true effect on the domestic economy as a whole. In today's complex global economy free trade often indicates much more than a free flow of products across borders. Other factors such as services, management, labor, capital, and industry join the flow. This changes slightly the face of analysis, which must consider more topics than simple economic efficiency. While international trade may provide boosts to the economic growth process, it has been noted that the sustainability of ecosystems and an equitable basis of exchange are conditions that must also be satisfied before the international economy can become beneficial for all involved (WCED, 1987). There are many concerns that international trade has failed this requirement on both fronts, with both equity and the environment suffering from its consequences.

2.1.2 Environmental Consequences of Free Trade

In this sea of criticism some beneficial relations have been hypothesized with respect to the environment. These relations have been based in the three basic reasons which follow (Jaakonkari, 1996):

1) Con el incremento del ingreso, la gente necesita preocuparse menos por la supervivencia del día y puede darse el lujo de reclamar una mayor conservación ambiental en aras de la amenidad.
2) El ingreso fiscal incrementado significa que las inversiones en la adquisición y/o el desarrollo de una tecnología ambiental adecuada, puede estar al alcance.
3) El incremento en la riqueza también permitirá al estado acceder al desarrollo de agencias ambientales y ministerios para administrar asuntos ambientales. [1]

While these possible positive connections between international trade and physically sustainable development proposed by Jaakonkari are interesting, they are suggested purely on the basis of theoretical and antidotal analysis and fail to take into account some of the pressing concerns commonly expressed with respect to international trade and sustainability. In addition, these hypothesized reasons for a beneficial relationship are all based on the economic growth associated with international trade, which is interesting when viewed in conjunction with much of the theory regarding

[1] 1) With the increase in income, people have less need to worry about daily survival, and can enjoy the luxury of demanding greater environmental conservation, 2) The increase in fiscal income indicates that investments in, or the development of, and adequate environmental technology can be in reach, and 3) The increase funds allows the state to develop environmental agencies and ministers for the administration of environmental matters.

economic growth's relation with the environment.

2.1.2.1 Economic Growth and the Environment

The inherent conflict between economic growth and the environment expresses itself in two distinct manners. The first issue addresses the current methods utilized in measuring economic growth which define this growth as the percentage change in the real gross domestic product (GDP). However, with the current national accounting methods utilized for measuring economic production, there exist no methods for the valuation of natural resources. In this case, the figures indicate economic growth when all that has actually occurred is an increase in the rate of depletion of natural or environmental resources (Ahmad, 1989). This type of economic growth, and the development process that rests upon it, is obviously unsustainable in the long run. While alternative national accounting procedures have been proposed which would take into account the value of natural resources, thus resulting in a more accurate measure of true economic growth rates, these alone cannot solve the incompatibility between economic growth and sustainable development.

2.1.2.2 International Trade and Physical Sustainability

Apart from international trades' relationship with an unsustainable economic growth process, it has also fallen under criticism for certain more direct links to sustainability. According to Daly, sustainable development requires living within the environmental constraints of both global and local absorptive and regenerative capacities. International trade allows the loosening of local limits through its importation of

environmental services. The end result of this process is a system in which 'each country is trying to live beyond its own absorptive and regenerative capacities by importing these capacities from elsewhere' (1993). Its international reallocation of environmental damages has the tendency to leave the impression on domestic decision-makers that the carrying capacity constraints have been reduced. However, in reality it has simply converted the varying local constraints into one large global constraint that is much more difficult to manage than a series of problems at the local level. In this manner, the process of international trade not only threatens the physical sustainability of the economic system through its associated economic growth, but also presents additional environmental challenges which would not have been present if the economic growth had been achieved in a closed or more tightly regulated economy.

2.1.2.3 Market Failures and Public Costs

In addition to these direct concerns over the environment, many concerns have been expressed with respect to free trade's reduction in the government's ability to correct market failures. These market failures, such as the inability of the free market to effectively allocate and value public goods such as natural resources and the price distortions resulting from external and social costs of production, have been seen as a direct threat to the sustainability of the development process.

These problems arise principally from free trade situations between nations with unequal legislative bases with respect to the correction of market failures. The first conflict between sustainable development and international trade results from free trade in which nation A requires the internalization of external costs, while the industry of the

nation B enjoys a lax regulatory environment in which pricing and production decisions do not include external costs (Daly, 1993). In this case firms in nation B will enjoy artificially lower costs, and drive the competing firms in nation A out of business. In this situation, as the non cost internalizing industry wins a greater market share, a net increase will occur in the associated external costs which must generally be borne by those with the least political voice, such as the environment and the relatively powerless segments of society.

2.1.3 Equity, Poverty, and Marginalized Peoples

Despite these extensive concerns, the environment is not the only area of criticism of international trade and its associated economic adjustments. This process has been questioned at all levels, from the broad economic theories upon which it rests, to the particular methods of data measurements that it utilizes in evaluating its performance. Almost without fail, each time the question ultimately returns to a fundamental doubt of the system's ability to equitably address either the environmental concerns just addressed, or social welfare and equity.

2.1.3.1 Distribution Effects

While the literature seems to agree upon a general improvement in incomes associated with economic growth, it is not to be assumed that the results of economic growth are evenly distributed among the poor. The effects upon minorities, women, and the 'absolute' poor can vary from this trend. In a 1995 study the effects of neoliberal policy enactments in developing nations were studied using a variation of the poverty gap

method. This method not only accounts for how far an income is below the poverty line, but it is also weighted to give those with the lowest incomes a higher rating. This method increases the poverty index not only when income is transferred from the poor to the rich, but also when income is transferred from the poorest of the poor to those only slightly better off than themselves (Balisacan, 1995). This study indicated that macroeconomic adjustment policies designed to promote international trade and economic growth, such as currency devaluations, have had their strongest adverse impacts among the 'absolute poor' in rural areas.

2.1.3.2 Gender Disparities

The disproportionate effects upon women have also been widely evaluated in the literature. The unequal burden that economic growth and the development process place on women has been attributed to two principal factors. The first is associated with cultural and social structures. With respect to this factor, the FAO has indicated that 'las causas radicales de la pobreza permanente y la inseguridad alimentaría entre las mujeres rurales y las familias que ellas sustenan están interrelacionadas: escaso acceso y control de los recursos productivos y servicios, sub y sobre ocupación, desigualdad en las oportunidades de empleo y retribuciones, exclusión de la toma de decisiones y de la formulación de políticas, y un entorno legal desfavorable'[2] (Department of Sustainable Development, 1997). In this type of social structure, where women often have little to no say with respect to allocation of resources, any changes in the traditional labor allocation

[2] The radical causes of permanent poverty and nutritional insecurity among rural women, and the families that they sustain, are interrelated: scarce access and control of productive resources and services, under and over occupation, inequality in employment opportunities and pay, exclusion from decision making and policy formulation, and a disfavorable legal framework.

among genders (such as that which often associated with the economic restructuring stimulated by international trade) tends to augment the workload and poverty of women relative to their male counterparts. A second factor is related to the exclusion of women's issues, problems, and work structures in development and economic planning. By excluding these issues, many proposed and implemented solutions ignore a woman's needs, and may actually augment the female workload. If a full understanding of the woman's actual role in the household, community, and production systems is not understood before beginning project planning, it is highly unreasonable to expect that the outcome will be beneficial to this sector of the community.

2.1.4 Community Impacts

Many of the equity concerns arise from the large variation in wage levels across countries and trading partners. However, trade theory does indicate that a harmonization of wages and equalization of returns to capital should occur across low and high wage nations, theoretically improving equity. While income distribution and equity concerns would theoretically be improved under free trade in the nations where they are needed the most, it has been noted that this is not necessarily the only or best way to measure quality of life. As derived from the writings of Vandana Shiva, there exists a real need to distinguish between that which is real material poverty, and that which is only culturally perceived as poverty (Braidotti, 1994). To these ends, an evaluation of equity must consider more than simple income distribution. One of the factors apart from income affected by international trade, which appears to have real implications for equity and

sustainable development, is community and social structure. These structures are also seen to be threatened in the face of international trade.

The deregulation of both internal markets and external trade have been held to blame for a concentration of power and a reduction in both community sovereignty and in local control over resources. According to Careaga et al., the current process of globalization results in the 'imposición de un estilo de vida, en un solo modelo de desarrollo que supuestamente debería ser adoptado por todos. . . . [E]stá fundado en un ejercicio de poder que coloca a ciertos grupos sociales en condiciones de dominación por otros. . . . La desregulación [del mercado] permite a los actores económicos liberarse de toda responsabilidad [social y ética, y resulta que el poder generalmente] está en manos de personas e instituciones que se encuentran muy lejanas de aquellos que sufren los efectos negativos de estos procesos' (1997)[3].

These global power structures resulting from deregulation are not the only manner in which free trade is seen to threaten the local community. The growing mobility of capital and its pressures on labor reallocation has also come under fire. As Daly comments, there exists a great chasm between economic view of man as a 'self-contained individual who is infinitely mobile and equally at home anywhere' and the reality of human nature which indicates that the 'individual identity is constituted by their relations in a community' (1993). He goes on to note that '[t]o regard community as a disposable aggregate of individuals in temporary proximity only for as long as it serves the interests

[3] . . . results in the imposition of a certain lifestyle, in a single model of development that supposedly should be adopted by all. It is based in an exercise of power which places certain social groups in domination of others. The deregulation of the market allows economic players to free themselves from all responsibility, social and ethical, and results that the power generally lies in the hands of people and institutions located far from those that suffer the negative effects of these processes.

of mobile capital is bad enough when capital stays within the nation, but when capital moves internationally it becomes much worse'.

This geographical reallocation of labor is not the only type of labor restructuring seen to have potentially negative outcomes for the community and social structure. Johnston and Kilby note that intersectoral transitions result in the need for an adjustment by the factors of production, including labor. This results in the need for an evolution in social structure, which is required to adapt to new institutions (factories, competitive job markets, urban modernization, etc.) After this transformation begins, communities are left unsure as to their roles in the new economic structure, a factor which often leads to social problems (1975). This may result in a relative increase of social disease such as domestic violence, alcoholism and drug abuse accompanying this process.

These threats to the community and social structure, along with accompanying environmental damages, must be weighed against the benefits of international trade in evaluating its true relationship to the sustainability of the development process. It must also be taken into account that many of these problems exist even in a closed economy that is experiencing domestic restructuring, growth, and other market changes. Due to these direct threats to the environment and equity on both a national and international levels, strong intervention in the economic process to help correct the extensive market failures and limit the pace and type of economic growth is often seen as a necessity. As stated by Muhhamad Yunas, of the Grameen Bank, '*unrestrained* growth is the ideology of the cancer cell' (Danaher, 1995). However, in the face of free trade, the scope of possibilities for restrictions and corrective actions on the part of individual nations is sharply limited.

International trade does have the potential to ease the unsustainability of the growth process by way of increased efficiency, technology transfers, and finally a more educated and aware consumer base. However, it also presents a variety of threats to the environment, equitable power distribution, traditional community and social structures and to the governments ability to regulate market failures. With these conflicting aspects, the relationship between international trade and development can be difficult to define, and most likely has the potential to vary depending upon the relative legislative, social, cultural and economic situations of the trading partners. While its exact impact on rural development may be hard to define, international trade does appears to offer a variety of theoretical pitfalls to the rural agricultural communities throughout the developing world. The following section presents an evaluation of literature which has reviewed the specific effects of trade liberalization and globalization on the Mexican peasant economy, community and individuals.

2.2 The Mexican Rural Community in a Global Market:

The impacts of globalization on rural Latin American societies (including those of central Mexico) are expressed in a variety of ways. Their identification includes the evaluation of social, political, economic, and cultural reconfiguration, the analysis of social actors and movements, and the discussion of alternative development processes which these communities are exploring. These reactions to the process of globalization tend to form two general groupings which include both affects on culture and rural identity, and change in rural societies and production systems.

2.2.1 Cultural Effects

Many researchers have evaluated how the increasing process of globalization is affecting the individual though eroding cultural bases, changing production strategies, and altered political structures. Quintanar and Jarillo (1998) have analyzed the impacts of globalization, and associated changes in Mexican politics to a neoliberal economic standpoint. The impacts were evaluated not on the conventional issues of unequal economic development but rather on the faltering of social development. This lagging social development was analyzed with respect to its consequences on the cultural base of the strongly affected Indian minority. The principal method utilized by these researchers for analyzing the effects of external society and changing economic and political frameworks on the selected indigenous communities was through an evaluation of traditions expressed through various festivals and celebrations. The authors concluded that while these traditions and customs continue they tend to express degrees of influence from external society. This was taken to indicate that the indigenous culture is not destroyed by increased interaction with other ethnic groups, but rather reacts in an ever-changing evolutionary response which allows the community to maintain its ethnic identity while permitting it to blend into a wider and changing world.

2.2.2 Impacts in the Agricultural Sector

In general, the effects seen on producers within the agricultural sector are a bit more definable than those demonstrated on the cultural side. In many cases the criticism has focused on the entrance of large corporations into agricultural sectors before operated

by small producers. This process is generally associated with an increase in landless labor, reduces returns to labor, and increases in exploitation.

Attempts to ease these transitions in the agricultural sector are varied in their approaches. In many production sectors, alternative organization strategies have been suggested. The formation of cooperatives is one such strategy. According to Salas (1998), the process of cooperation among dairy producers "sí es necesario para permitir sus productos insertar en esta nueva economía agrícola.[4]" However, those researchers working with other types of producers are not in as strong of agreement with the feasibility of this option due to the varying nature of the different industries. For example, in the sugar industry the potential for cooperatives was not seen as large due to the fact that the majority of the producers are already producing under some sort of contract agreement with the large corporations (Hernandez, 1998).

While changes in producer organization is one suggested method for the empowerment of rural labor, another idea slightly more radical in its approach is that of adjustment in corporate structure, as presented by Renard (1998). This work evaluates the world banana industry, with respect to its domination by major transnational companies in all stages of production, transportation, and distribution. This is seen to present strong challenges to equitability and profit distribution. The inequitable returns to the rural labor force present in this industry were blamed on the corporate domination feature. Feasible alternative production and ownership systems which alleviate this discrepancy are presented. In the case of the 'equitable banana' company, the companies marketing strategy focused on environmentally sustainable production methods (similar to the

[4] . . . is necessary to permit that its products insert in [the markets of] this new economy in agriculture.

organic farming systems which have been gaining popularity in recent years) in addition to an equitable return to the rural producers and labor force. While this particular company has principally conducted its marketing in Great Britain and Northern Europe, it is not the only one of its type. A similarly structured coffee company is enjoying success, and there still exists the potential for many more industries to exploit people's desires for altruistic acts and humanistic development, while assisting to diminish unequal profit distribution at the same time.

While these two approaches of producer and corporate reorganization may serve for specific types of industries, others do not lend themselves so easily to the process. In general many of the basic grains tend to be produced individually and then purchased from the producer. In these cases one of the most effective manners to augment producer returns has been the implementation of new technology and production techniques. While extension and education have been advocated as effective methods for easing traditional producers into a global market, the effectiveness of this approach is entirely dependent on the training and ability of extension workers, their ability to respect and incorporate the producers traditional knowledge, and upon appropriate funding (Cruz, 1998). The issue of appropriate funding addresses not only under-funding issues, but also the problem of over-funding, in which the agricultural sector and associated markets do not have the capability to adsorb the expanded production resulting from an over-active extension sector.

2.2.3 Globalization at a community level

Whether effected by transnational corporate domination and control of an agricultural sector or by a steady erosion of cultural bases, an inescapable conclusion is that rural peoples, producers, and communities are affected by the process of globalization. This affect can be seen as positive or negative. Negative in that it often results in a deep and non-reversible change in culture and tradition, changes traditional agricultural, and often provides inequitable returns. It can also be seen as positive in that it can bring new opportunities to producers. These opportunities can consist of completely new production strategies, or may only consist of income augmentation abilities (such as local factories) which give producers the means to maintain their traditional production strategies which may have otherwise been abandoned due to seasonal and annual fluctuations in returns. Whether this affect of globalization on rural communities and individuals is seen as positive, negative, or a combination of both, an inescapable conclusion is that globalization has, and will continue to change the community structure, individual production decisions, and culture and traditions of these peoples.

The process of globalization appears to affect the people in these areas in two distinct, yet interrelated manners. On an economic level changing prices and demands required the adaptation of traditional producer strategies. There was also visible an increased interaction with the outside world, which tended to affect both the traditional cultural and production practices. These new and shifting practices seem to offer a myriad of opportunities and pitfalls to the rural community, and whether the final outcome will be positive or negative seems to be a question still up in the air. Many

factors have the potential to affect this outcome, including government policies towards equitable trade, decisions made by large and transnational producers, choices made by consumers, and the amount of resources dedicated to assisting these rural communities in their process of transition (including extension, education, counseling, credit and technology transfer).

3. ECONOMIC AND POLITICAL FRAMEWORK

To more fully understand the framework in which the communities under study are placed, it is first necessary to have some understanding of the political and economic background of the country as a whole, and of the region in specific. Towards this goal, the following section evaluates the historical framework of Mexican economic and political development and its specific impacts on agricultural and industrial policy. With this foundation laid, the succeeding chapter will evaluate the specific region under study to provide a basic understanding of its industrial and agricultural development and existing social and production structures, thus providing a context for the current study.

3.1 Mexico's Economic and Political Development:

Agriculture and industry have both played major roles in the economic and political development of Mexico, and have in turn been strongly affected by the political and economic ideology expressed throughout Mexico's history. This ideology appears to have been strongly influenced by Mexico's historic colonial relations which laid the foundations for its formal economy. These relations must be understood for both their contributions to Mexico's historically distorted development as well as their influences upon popular ideology. To better understand these factors which have such strong influences on Mexican political and economic ideology, a brief history of their development is presented.

3.1.1 Colonial Trade Relations

Natural resource extraction and primary commodity exportation have been the basis of the Mexican formal economy since the late 1400's, and the so called 'discovery of America'. The conquistadors extracted, in their ruthless manner, the natural resources of the area (primarily silver, gems, and agricultural products) for transport to Europe. The existence of these natural resources made these newly discovered lands of Latin America a treasure for Spain and various other European nations, whose own lands were long since depleted. In addition the imports of precious metals were very helpful in the funding of various wars and skirmishes among the assorted European royalty. The Spanish imports of American treasure, which peaked in the late 16th and early 17th centuries, were so great that they strongly intensified an European inflationary trend. Through their contributions to monetary instability, these imports indirectly contributed to the large fiscal imbalances and regressive taxation of the European peasantry which eventually resulted in the political collapse of many of the European royal states (Fisher, 1996).

This vast extraction of resources, while perhaps damaging to the existing European state, left even more lasting marks on the Mexican economic and political system. This distinct trading relationship, where the southern developing nations such as Mexico provided exports rich in agricultural commodities and raw natural resources, is one that has prompted great concern even in modern times with respect to issues such as terms of trade. While exports have been dominated through the centuries by basic commodities and natural resources, the imports have been a conglomerate of manufactured and industrial goods. While today the developing countries are still

exporting the same basic commodities that they were producing one hundred years ago, the products which they are importing from the developed countries are becoming increasingly more complex, and expensive. Theoretically this will result in increasing disparities in the terms of trade between these nations, with the relative value of goods produced by the higher income nations increasingly rapidly, while the value of the commodities and raw materials produced by the low income nations remains relatively constant. In such a case, it takes more and more of the low-value Mexican production to make enough foreign exchange to purchase the same amount of goods from the Northern nations.

This secular decline in the terms of trade has been at the heart of a modern approach to the evaluation of Latin American development called dependency theory. As the process of international trade diverged from its theoretically mutually beneficial status, the deteriorating terms of trade are effectively seen as 'underdeveloping,' or draining the economy of the unequal trading partner, rather than contributing to economic wellbeing. With this perspective, the Latin American nations were seen as passing directly from a formal colonization before their respective revolutions, to being informal colonies of the developed world due to the continued extractive and controlling nature of their trading relations (Haber, 1997).

3.1.2 Income Inequalities

An unequal trading relationship however is not the only inheritance from Mexico's longstanding colonial domination. The unequal distributions of both income and political power which were definitive of the colonial system also had a legacy for

post-independence Mexico. The nature of colonial Mexico differed greatly from that of the early British colonies, and its 'extensive existing populations of indigenous peoples, [along with] the Spanish practices of awarding claims on land, native labor, and rich mineral resources to members of the elite encouraged the formation of highly concentrated landholdings and extreme inequality' (Engerman and Sokoloff, 1997). It has been hypothesized that these initial inequalities present in colonial Mexico, which had led to such highly unequal distributions of both wealth and political power so early in its history, were in a way self-perpetuating, even beyond independence. Mexico's economy, due to its initial factor endowments and unique assignment of land and labor rights, had been disposed since the beginning to large scale agricultural enterprises. Large scale agriculture along with its inequitable returns remained dominant well after Mexican independence in the form of the hacienda, and both power and wealth remained concentrated in relatively few hands (ibid, 1997).

3.1.3 Agricultural and Industrial Reform

It was not until the revolution of 1910 that this concentration became officially questioned. A strong public outcry for equity in land distribution exhibited itself in a complete reconstruction of agricultural legislation. The new legislation confiscated many of the existing haciendas and redistributed this land among the peasant class. Through the creation of ejidos, the base group for Mexican communal land ownership programs, plots were actually owned by the community, and could not be bought or sold. In this manner, it was hoped to avoid the reconglomeration of ownership and the associated exploitation by those with more financial resources. The appropriation of large land

holdings from the rich was not the only step Mexican lawmakers took in the 20th century in their attempt to stem a long history of economic exploitation and inequality. The development of the industrial sector was also effected. An ideology strongly influenced by dependency theory (and some would say even more influenced by kickbacks and other industrial 'incentives' to the powerful national elite) guided many political decisions regarding economic regulations. Strong trade protection was the preferred policy to protect fledgling national industries, and foreign investment was discouraged in an attempt to avoid the threat of *decapitalization*.

3.1.4 Adoption of Neoliberal Economics

These policies were tied together with their common rejection of the neoclassical free-market economic model promoted in the United States and Britain. However, after centuries of economic delay and in direct response to the economic crisis of the 1980's, a new approach began to be considered by Mexican policy makers. In partial response to pressure from international creditors to begin pursuing a path more conducive to economic growth and the generation of debt repayment capital, Mexico began a slow process of economic restructuring. Trade liberalization, which began slowly, cumulated in 1994 with the signing of the North American Free Trade Agreement. The privatization of national industries began with the sale of Telmex, the national phone company, and the liberalization of the electrical industry is currently on the table. In addition, the ejidal law structure was altered allowing the sale of the communal lands, with some limits to avoid reconglomeration. However, despite the extensive nature of these changes, they are still relatively new, and stand in strong contrast to a longstanding economic-political

ideology. As much of Mexico's influential ideology and values have been claimed to be dedicated to correcting ancient inequalities present in its socio-economic system, it is important to know if this new path holds any real dangers for equality. At the crux of two converging ideologies, many fear that in the confusion equity will be sacrificed. This change orientation can be seen in the changes in programs and policies, as evaluated in the following section.

3.2 Government Programs and Policies

Government agricultural policies are affected at two general levels. At the producer level the PROCAMPO program provides direct producer subsidies, while on the national level trade policies and price support programs have provided income protection to the rural sector. These two policies are directly related, as PROCAMPO was initiated explicitly to assist the rural producer's merger with the large unprotected and highly competitive agricultural markets created by NAFTA. In addition, the Mexican government has strong ties to the agricultural sector by way of the ejidal system. This system, which was developed as part of the Mexican Constitution following the Revolution, was the backbone of land distribution programs and until recently included heavy government involvement. This section provides a review of changes in the ejidal system, the implementation of PROCAMPO, and a general review of changes in agricultural trade policies. This allows for a better understanding of how the previously reviewed shifts in economic and political ideologies have manifested themselves in the policy variables.

3.2.1 The Ejido

The ejido is the principal land tenure system among governmentally redistributed lands in Mexico. These lands, distributed to and managed by individual rural communities, consists of both communal lands for common use (such as grazing, collection of edible herbs and plants, firewood, and even commercial industries such as logging and mining if resources permit) and of individually assigned parcel allotments for planting and private use. Land use, financial management, and other decisions related to the common lands and services (such as irrigation) are typically controlled by an ejidal committee. Originally, the individual parcels were not owned. The ejido member had rights to cultivate this land, and this right could be passed on to family members, who would then take the original member's place as an ejidal member. This right could not be bought or sold.

In 1993, changes in Article 27 of the Mexican Constitution allowed for the privatization of the ejido, a change which was laid out by the guidelines set forth in the Ley Federal de Reforma Agraria. This change in policy is still the object of widespread debate which questions the motivation of the government and the potential outcomes of this policy. The government stated that its actions were motivated be the fact that "la situación del campo mexicano requiere de profundos cambios para poder recuperar la dinámica de crecimiento, que permita elevar el bienestar de los productores y trabajadores rurales[1]" (Diego Quintana, 1994). In addition, the presidency stated in its *Iniciativa de Ley Agraria, México* (1992) that the ejidal reforms were intended to promote "mayor justicia y libertad, proporcionando certidumbre jurídica y los

[1] The situation of the Mexican countryside requires profound changes to recuperate the growth dynamic necessary for an elevation of welfare among rural producers and laborers.

instrumentos para brindar justicia expedita, creando las condiciones para promover una sostenida capitalización de los procesos productivas, propiciando el establecimiento de formas asociativas estables y equitativas y fortaleciendo y protegiendo al ejido y a la comunidad[2]" (Diego Quintana, 1994). These goals were hoped to be addressed specifically with an improvement of capital availability, and the formation of producers and marketing associations to achieve economies of scale.

These benefits directly address demands from small private producers (non-ejidal members) for permission to form alliances and associations with ejidal producers, and demands from ejidos for the credit availability that is hoped to accompany a clear title to the land parcel. In addition, the reduction in the governments role in the ejido addresses ejidal demands for greater autonomy in decision making (De Grammot, 1994). While producer demands may have influenced the governments privatization of the ejido, many suspect that pressures from World Bank lending stipulations for a neo-liberal, free market policy approach may have influenced the government decision to purge the seemingly Paleolithic, pre-modern policy from their constitution.

NAFTA negotiations were also seen as possibly dazzling policy makers with implied promises of first world membership and economic integration upon the annihilation of its out of date agricultural policies. In fact, Article 501 of the NAFTA negotiations, which was proposed by Mexican negotiators, states that the principal objective of removing trade barriers was to promote competition and increase " la

[2] provide greater justice and liberty, proportioning both certainty of jurisdiction and the tools needed for expedited justice, creating the conditions necessary to promote a sustained capitalization of productive processes, allowing for the establishment of stable and equitable associative groups, while strengthening and protecting the ejido and the community.

eficiencia a través de aumentos en la escala de producción"[3] (Calva, 1994). The implementation of this attractive economic principle would have been impossible under the existing ejidal land tenure system, which prohibited land concentrations and negated the possibility that large scale operations might become a part of the Mexican agricultural system. Without reform of the ejidal law, Mexican policy makers may have seen themselves at the perpetual mercy of the lower production costs present in the large scale producers of Canada and the United States.

While many actors, from the small producer, to the multinational lenders, to the powerful trading partners, may have influenced the decision to privatize the ejido, and many benefits have been proposed, widespread concerns were still present. Many feared that with ejidal lands subject to sale and purchase in the free market, small producers would not be able to compete in Mexico's newly liberalized agricultural markets and would be forced out of production and off their lands. Concerns have also been raised that the land concentrations made possible by the change in Agrarian Law would not result in greater efficiency brought forth by economies of scale, but rather result only in an associated concentration in income, which rural Mexico can ill afford (Calva, 1994). The lack of transition programs for those peasants caught in the unpleasant technical process of 'sectoral readjustment' has also been cited as a gross oversight on the part of policy makers (De Grammot, 1994).

The majority concerns are based on the fear that small producers will be pushed out of production by larger producers with greater access to capital and technology. Forced into urban poverty and landless labor, the small parcels will by incorporated into large productive units and the income from Mexico's agricultural production, which once

[3] increase efficiency by way of increasing the economies of scale

served to support a large base of producers from the lower economic strata, will now be in the hands of very few, rich, producers. Some authors, however, have found this approach to be exaggerated. Cruz and Soledad state that while the new Ley Agraria has not effectively been accompanied by access to credit, as was hoped by proponents of the change, it has not translated into a rapid privatization (or selling-off) of the ejidal lands either, as feared by opponents (1996). In fact, it may be that the greatest change effected by the change in ejidal law, is a change in ideology and policy orientation. De Grammot's evaluation of the Mexican government's motivation concludes that the government's true goal is not based in the betterment of the peasant class, but rather in the hopes of breaking with the agrarian ideology and social state born from its revolution, and associate itself with the currently popular neo-liberal model of the first world (1994).

This shift in ideology to the free market model is not limited to changes in the ejidal laws. It can be seen in agricultural programs at all levels, from producer subsidies to trade liberalizations. The PROCAMPO program, which allocates producer subsidies, is seemingly one program that stands out against this trend. However, one must take into account that this program was instituted as a transition program against the background of liberalization, to help the producer adjust in a time of rapidly changing prices, markets, and credit availability. The details of this program are presented in the following section.

3.2.2 PROCAMPO

Direct subsidies to the agricultural household come in the form of the PROCAMPO program. PROCAMPO a program of the federal government designed to meet the demands of peasant organizations and the needs of all rural producers. The program consists of an income assistance program to agricultural producers by way of per hectare payments for those lands which have been planted in basic grains and oilseeds. The stated objective of the program has been to elevate the welfare and income while assigning resource in a more equitable manner. A program of this type was indispensable with the rampant trade liberalizations being conducted as part of the North American Free Trade Agreement.

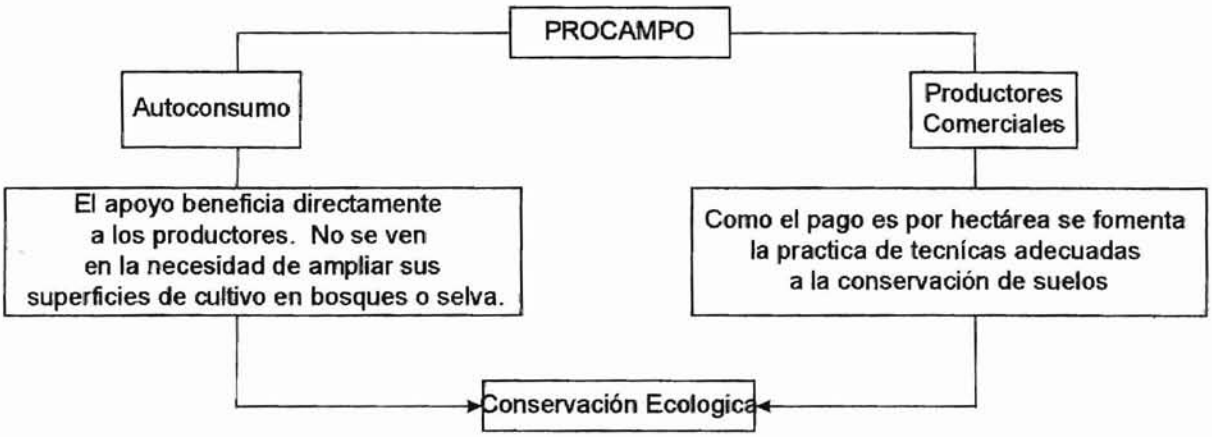
At a national lever this program has included more than two million subsistence farmers who were only marginally included in previous assistance programs. The program has a duration of 15 years starting in 1994, equal to the duration of the NAFTA phase-out period for agricultural tariffs and tariff-rate quotas. It has been stated that this temporary nature is established in the hopes that recipients will understand the temporary nature of the assistance, and apply it towards long run investments in their production systems. However, this application has not been occurring, primarily due to the minimal nature of the assistance.

The general goals of the program relate to the environment, producer welfare, and technology implementation. These goals are defined by specific methods and objectives, and are explained in more detail in the following statements from PROCAMPO literature. Each of these objectives is discussed along with those concerns which have

been raised regarding conflicts between the PROCAMPO objectives and the reality of the Mexican agricultural sector.

1) PROCAMPO claims to improve the environment by encouraging the recuperation of forest and jungles, and also affect a reduction in the use of agro-chemicals. This process is sustained in the following diagram, taken directly from PROCAMPO material:

Figure I: PROCAMPO's relationship with the environment. Source: (SARH).[4]



This diagram indicates that due to the assistance provided by PROCAMPO,

[4] PROCAMPO

subsistence production — as the payment are made directly to the producer, they will not have the economic necessity to expand into forests and jungles.

commercial producers — as the payment is on a per/hectare basis, producers will have incentive to form appropriate technology for soil conservation.

resulting in ecological conservation for all

producers do not have the financial need to utilize currently forested lands. However, they have not taken into account the consideration that due to per hectare payments, there could exist a financial incentive for producers to increase the land area under cultivation in order to increase benefits. In this scenario, PROCAMPO could actually subsidize the process of deforestation when that cleared land is then converted to agricultural use.

2) PROCAMPO claims to elevate producer welfare and to assign resources in an equitable manner. Towards these goals the subsidies are distributed to those producers which have the least capabilities to enter international markets and to subsistence producers. However, these benefits are only available to those producers which own their own lands. In this manner, those producers with the least resources who must rent or lease their lands, are excluded from the assistance program.

3) PROCAMPO claims that these benefits also respond to producer demands with respect to technological improvement. However, the quantity of the benefits is minimal and will not likely be sufficient to effect any manner of technological implementation.

While many of the stated goals of PROCAMPO may be difficult to accomplish with the current program, these doubts as to its effectiveness are not those concerns normally expressed by recipients. A 1998 survey conducted by students in the Colegio de Postgraduados indicated that the most common producer concerns with respect to this

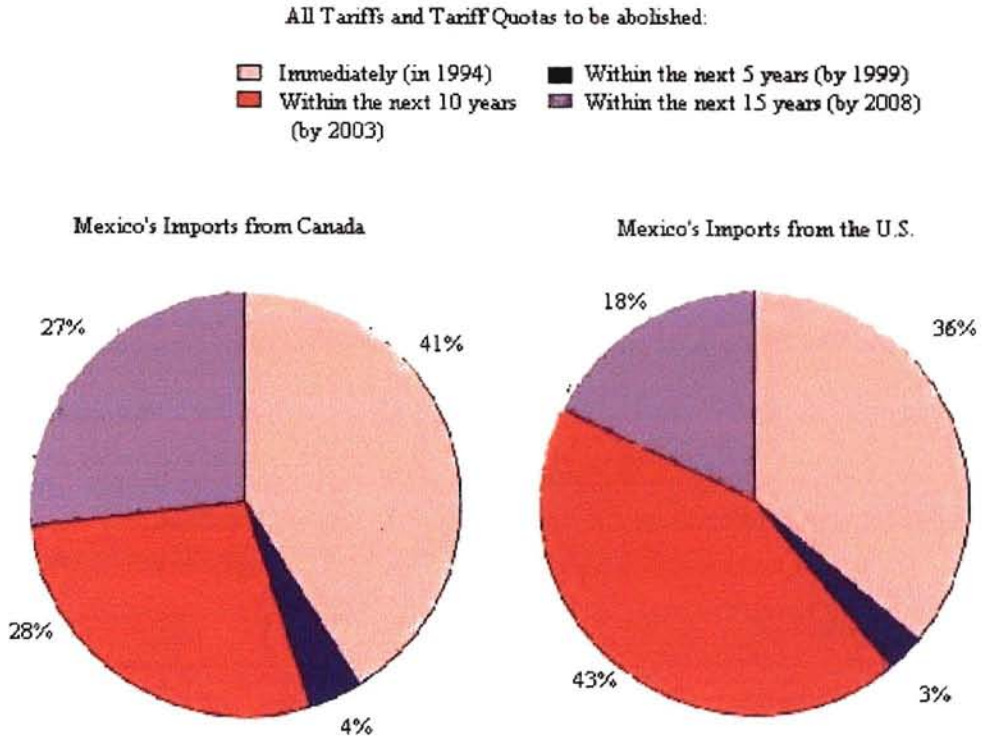
program are: 1) The amount of the benefits are insufficient to provide any real help with production costs, much less to enact permanent improvements, and 2) The timing of the benefits generally arrives at the end of the crop season, rather than at the beginning when capital shortages and difficulties are most likely to arise. The producers in the Xicohténcatl industrial region echoed these concerns. Their average PROCAMPO benefit was approximately $300 pesos/hectare, and while it tended to arrive in May (much earlier than those in the Colegio study), this is still two months after planting has begun.

3.2.2 National Agricultural Trade Policy

Protection has been the key word in Mexico's agricultural trade policy up until its surprising inclusion in the NAFTA for liberalization over a 15 year time period. In 1992, two years before NAFTA liberalizations began to take effect, Mexican import controls supported a domestic corn price 70% higher than that of world markets (Levy and Van Wijnbergen, 1995). This provided a large effective subsidy and income support to the country's maíz producers. However, this subsidy was quite skewed in that it ignored the poorest subsistence farmers whose production never entered the formal market. In addition, it augmented the incomes of producers with irrigated lands and higher yields disproportionately to those of poorer producers with temporal lands.

These and other agricultural protection measures were addressed in the North American Free Trade Agreement, which went into effect in 1994. As part of this agreement, tariffs and tariff rate quotas on 36% agricultural imports from the U.S. (and on 41% of imports from Canada) were immediately dismantled in 1994 (Figure IV). In

Figure II: Tariff reduction schedules applied on Mexican agricultural imports under NAFTA. *Share of volume, based on 1989-91 trade flows.* Source: OECD, 1997.



the next five years an addition 3% of U.S. products and 4% of imports from Canada were released from their previous protection. The rest of Mexico's agricultural imports from the U.S. and Canada are scheduled for liberalization over the next nine years as demonstrated by the attached figure (OECD, 1997).

4. REGIONAL CHARACTERISTICS

The communities under study in this research are all fairly isolated agricultural communities surrounding the industrial corridor of Xicohténcatl in the state of Tlaxcala. Tlaxcala, the smallest state in the Mexican Republic, is located strategically between the large markets provided by Mexico City to its west, and the seaport of Veracruz to its east (see Map I). This location has been historically advantageous to its industrial development.

Map I: Location of the state of Tlaxcala relative to Mexico City and Veracruz. Major highways highlighted in black. State boundaries in red.

4.1 Industrial History of Tlaxcala

The process of industrialization in this state has a long history, with its roots in the colonial construction of various textile works. While these early works were drastically changed with the nineteenth century adoption of British technology and large scale industry, the unique combination of rural communities and peasant agriculture with an extensive manufacturing base has a long tradition in this area. As stated by Gonzalez

(1991), while many 'aspectos de carácter tecnológico, ambiental y cultural . . . [han cambiado], la simbiosis entre agricultura e industria contínua existiendo.'[1]

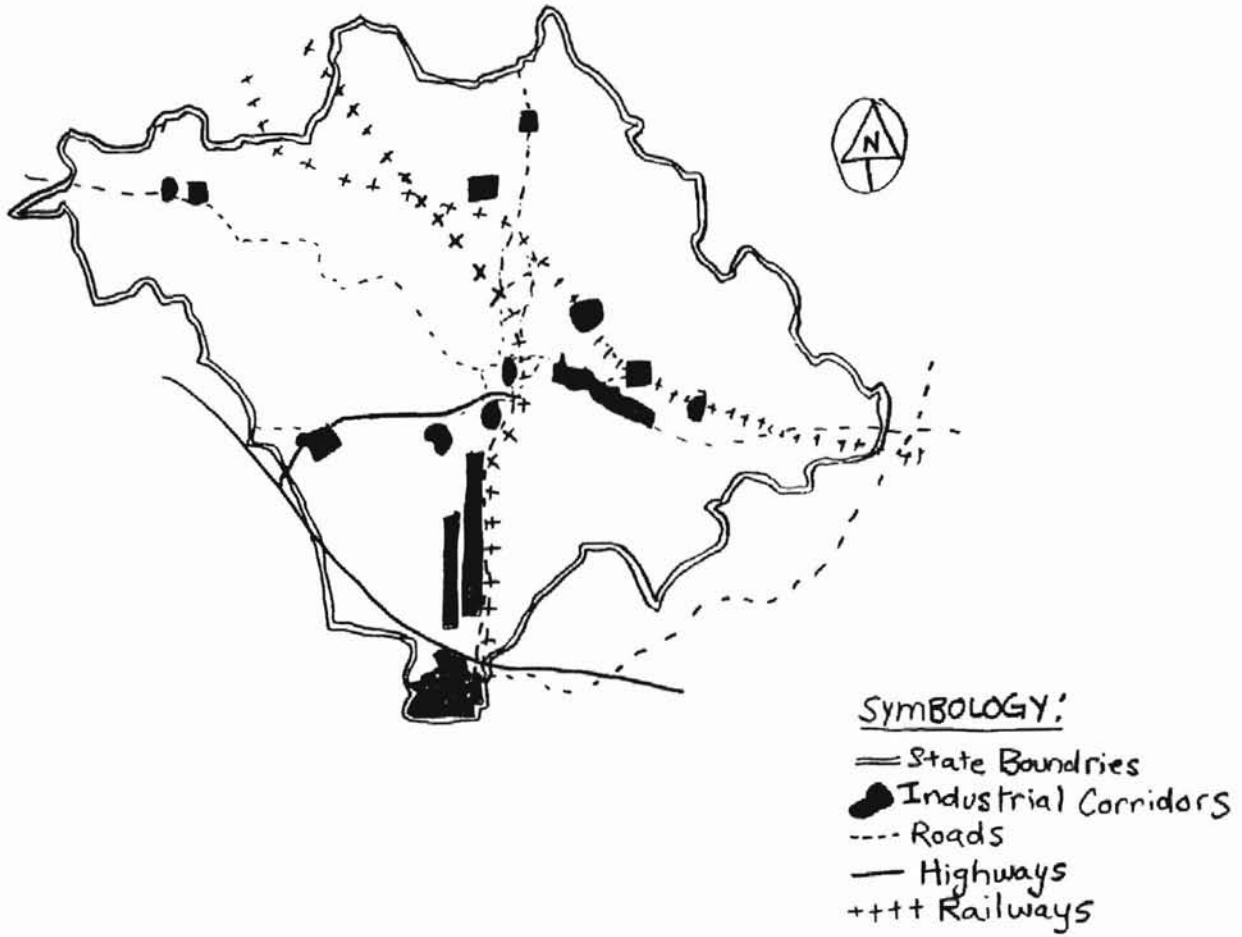
While the long-standing industrial character of the state has resulted in a unique relationship between the agricultural and industrial labor requirements, it has also made the industrial sector a natural object of political interest through its history. As a national industry, textiles previously enjoyed heavy trade protection. It has been hypothesized that this protection has weakened Tlaxcala's textile industry, making it less competitive with few quality control measures (Gonzalez, 1991). Due to these concerns, the probable impacts of NAFTA on Tlaxcala's domestic industrial sector are uncertain, and the ability of this sector to compete in a global market is unknown.

4.2 Modern Industrial Sector

While doubts surround the fate of Tlaxcala's national textile industry, this sector, while the oldest, is not the sole foundation of Tlaxcala's industrial base. Local politicians have taken advantage of the state's location, services, and experienced labor pool to promote the state as an ideal location for new industries, both foreign and domestic. Towards the goals of advancing economic growth and increasing employment by way of industrialization, the state of Tlaxcala has developed nine major industrial zones throughout the state, all of which are accessible to the necessary services such as transportation (by way of highway and/or railroad), water, electricity, waste management, and labor pools. The locations of these corridors and the various infrastructures which

[1] while many aspects of a technical, environmental, and cultural character have changed, the existence of the symbiosis between agriculture and industry has continued.

Map II: The state of Tlaxcala with industrial corridors, major highways, and railways indicated. Source: Secretaría de Desarrollo Industrial (SEDI), 1997.



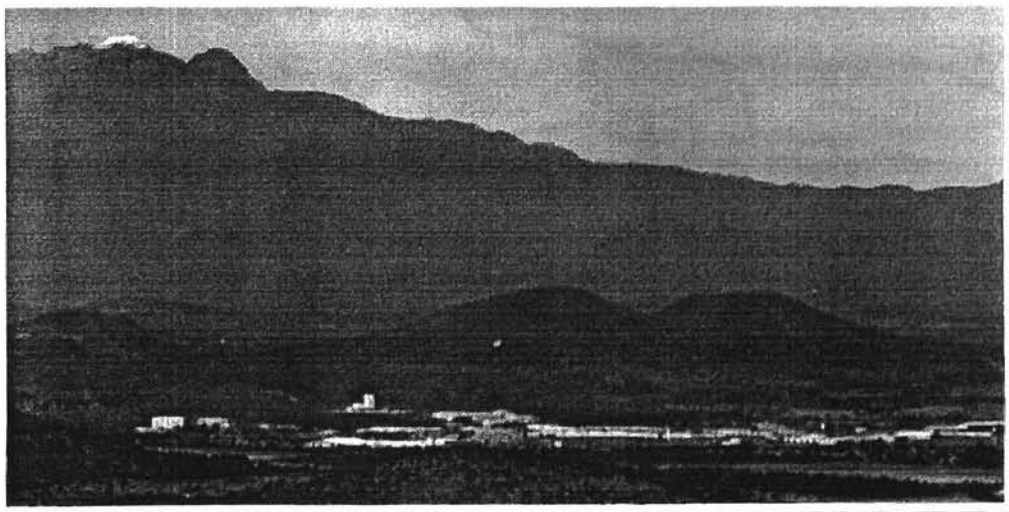
support them are indicated on the attached map (Map II).

These industrial corridors provide a combined employment for over 22,000 people, and house over 150 factories [Secretaria de Desarrollo Industrial (SEDI), 1997]. Sixty-seven percent of these factories manufacture products for exportation, and 22.5% of the factories have taken advantage of the temporary importation policies which allow for the temporary importation of inputs, utilization of local labor for fabrication, and re-exportation of the final product duty free (SEDI, 1997). While the trade liberalizing effects of NAFTA will reduce the reliance on such programs, the large portion of factories currently utilizing this resource indicates that a duty free export environment would be beneficial for Tlaxcala's industrial base.

4.3 Ciudad Industrial Xicohténcatl

Of all nine industrial areas, the largest corridor is the Ciudad Industrial Xicohténcatl in which over 19% of all Tlaxcala's industrial corridor factories are located, and which provides 27.5% of all industrial corridor employment opportunities. This

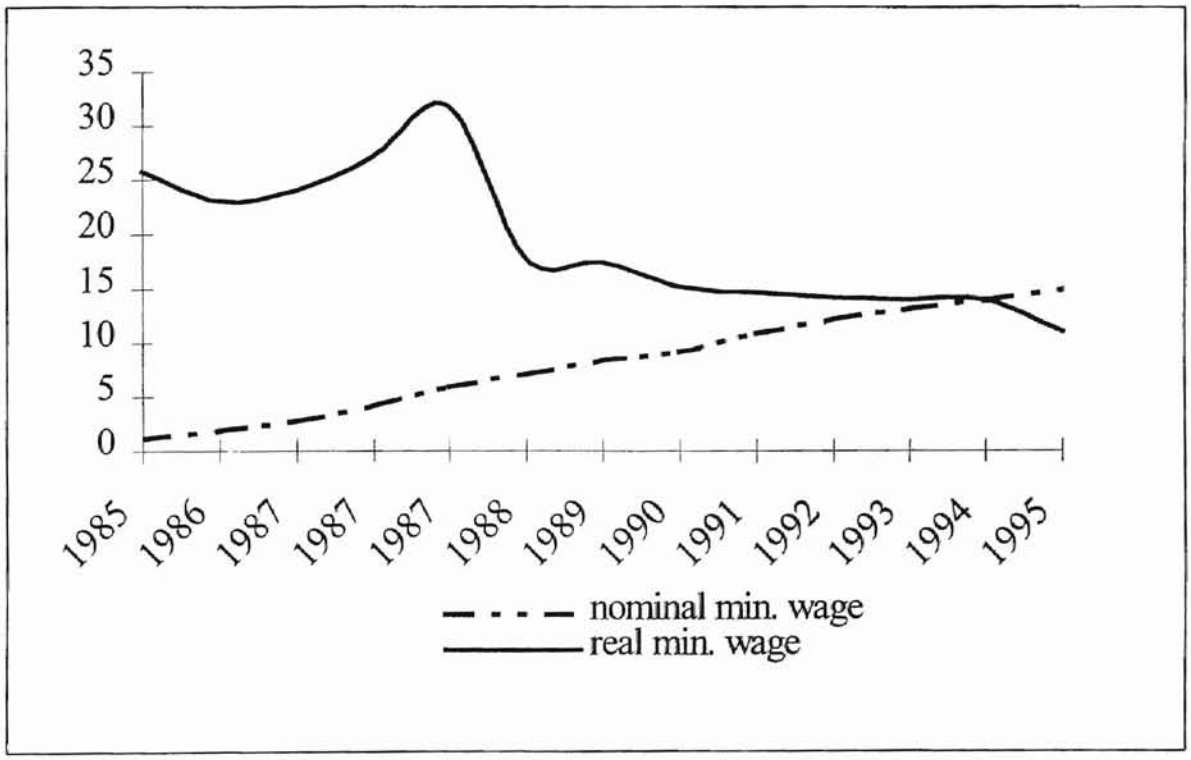
Image I: Xicohténcatl Industrial Corridor. Tlaxcala, Mexico.



industrial park is located in an isolated rural area approximately fifteen minutes to the northeast of Apizaco, a small city that provides much of the labor force for the corridor. While a large portion of the labor force does commute from Apizaco and other nearby cities, there are still plentiful employment opportunities for residents of smaller nearby agricultural communities.

The types of opportunities available vary by industry, and in Xicohténcatl the principal industries consist of chemical production and clothing fabrication along with the traditional industry of textile manufacturing. The chemical industry has distinct employment patterns from those of clothing and textiles. The chemical industry tends to offer employment opportunities directed towards both young and mature males, while the

Figure III: Demonstration of changes in Minimum Wage from 1985 to 1995 as represented by an average of nominal and real minimum wage across three economic regions in new pesos.

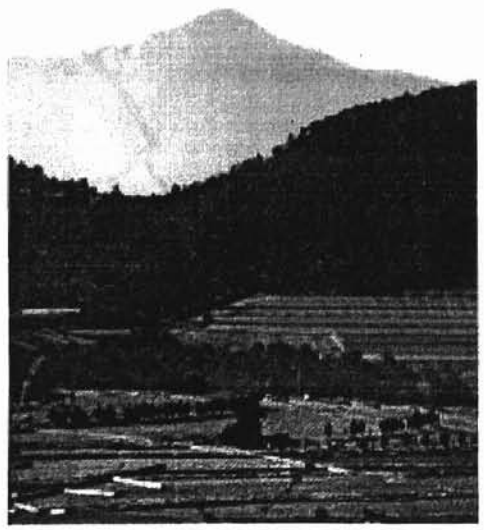


laws also restrict the length of the work day, and establish a minimum wage. This minimum wage is regularly updated to keep even with inflation, as can be seen in Figure III, and is currently approximately 35 pesos for an eight-hour workday.

4.4 Rural Villages in the Xicohténcatl Area

These positions are often accepted by young people who commute from a large number of nearby villages whose economies are principally based in agricultural production. The villages which are to evaluated in this study are those of Emiliano Zapata, Lázaro Cárdenas, Santa Fé La Troje, Capula and Zotoluca. The relative locations of these villages can be seen in maps III and IV. While some of these villages enjoy economic activities apart from agriculture, the agricultural sector is the principal (and in many cases the exclusive) employment sector for those who do not commute to participate in the industrial sector. It is hypothesized that the interaction of this population base, which has traditionally depended on subsistence agricultural practices, with the industrial sector will vary from village to village due to differences in resource endowments.

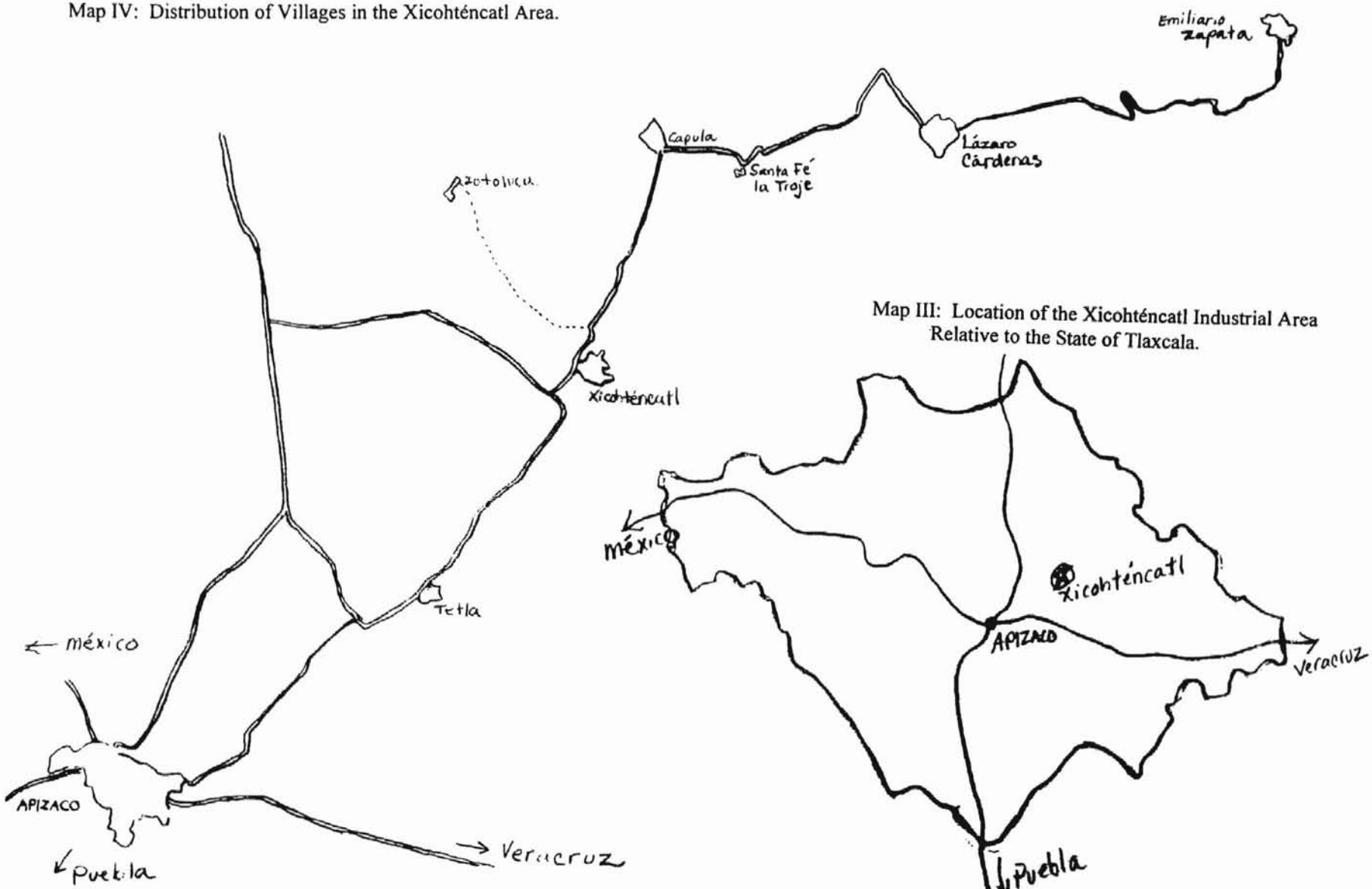
Image II: Volcán la Malinche and Cerro Tlacoxolo as seen from Emiliano Zapata.



4.5 Regional Climatic Factors

The distinct resource endowments cause agricultural practices to vary widely among

Map IV: Distribution of Villages in the Xicohténcatl Area.



Map III: Location of the Xicohténcatl Industrial Area Relative to the State of Tlaxcala.

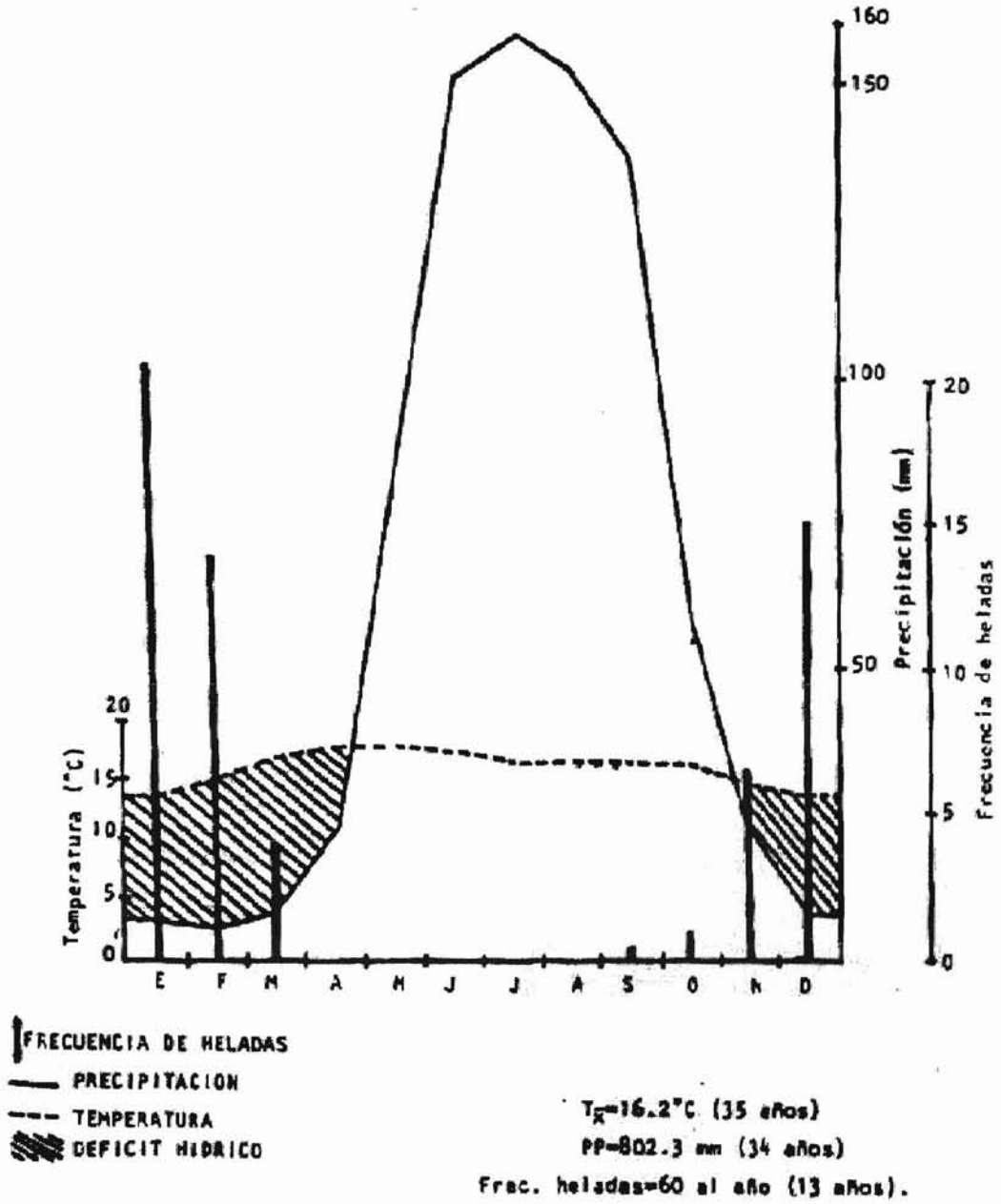
villages, and can cause measurable changes in yields, profitability and eventually the overall sustainability of the system. The most important resource endowment in determining production patterns across the area is that of water availability, which is affected by rainfall patterns. It is the seasonality and distribution of these patterns that serves as the guiding force behind production systems in the area. As can be seen in Figure IV on the following page, rainfall is present only in the growing season from April through October. This results in a water deficit throughout the dry season, and little to no soil moisture. This factor results in a heavy dependence on the arrival of the rainy season as crops cannot survive in the dusty soils without supplemental moisture.

The total rainfall received by this area is said to be influenced by the existence of the Volcán la Malinche which acts as a condenser for humid ocean winds (Luna, 1990). While this geographical feature increases the overall humidity of the region, rainfall can vary drastically across small distances within the area. Due to the overall height in elevation, relatively small intrusions (such as local ridges, hills, and mountains) can act as condensers, much as the Volcán on a smaller scale. This results in the creation of many microclimate regions alongside these intrusions with rainfall quantities, soil humidity, vegetation patterns, and irrigation and cultivation practices that can vary drastically from those of neighboring communities.

4.6 Agricultural Production Patterns

Due to the nearby existence of Cerro Tlacoxolo, the water resources of the communities in the Xicohténcatl region vary in association with their relative positions

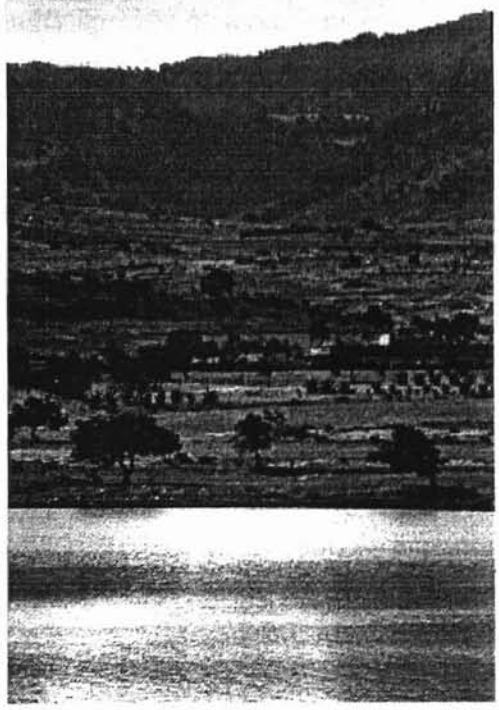
Figure IV: Climactic characteristics of western Tlaxcala. Source: Luna, 1990.



in the local geography. Those communities closest to the monte receive greater rainfall, and accordingly enjoy greater soil humidity and access to irrigation water. Zapata, located directly along the side of the monte has the lushest vegetation of all the towns included in this study. A small percentage of its agricultural lands have access to irrigation water, and the associated change in natural vegetation supports a small logging industry. Small flocks of goats and sheep are herded to the outskirts of town for grazing purposes, although due to overgrazing and timber removal, good grazing cannot be found near the village. These hardships result that only the poorest villagers continue attempting to exploit these resources.

Cárdenas, located at the base of the monte, enjoys a similar resource base, however, this village has utilized the equal initial conditions quite differently. The construction of two dams allows for the collection of water in the rainy season, and a small canal system channels this water down into the fields. While the percentage of crops under irrigation is much greater than that of Zapata, it does not enjoy Zapata's forest resources. While once also richly forested, these resources have been completely stripped due to their once active logging industry, leaving nothing but dry arid lands. The remaining towns of Santa Fé, Capula, and Zotoluca are locate further

Image III: Irrigation waters held by one of two large dams for the village of Cárdenas.



from the monte and have no water resources available for irrigation activity. In addition, vegetation is scarce, reducing the carrying capacity of public lands for livestock.

Despite these extensive differences, corn is the principal subsistence crop in all communities (except on Cárdenas' irrigated lands which support lettuce and other vegetables for commercial sale), and in many cases it is supplemented with beans, small grains and potatoes. Production is usually kept for household use, with any excess yield sold on the formal market. Unlike many more urban areas of Mexico, the corn is processed in the home for final use as tortillas which are made by hand. This food processing stage of the agricultural activity is labor intensive, and generally preformed by the women of the household. As a large percentage of the labor requirements in the industrial corridor are also met by female labor, the resulting impacts on the female workload will hopefully become apparent in this study.

With this general background provided of the industrial and agricultural characteristics of the region under study, community specific observations are presented in the following section to provide the reader with a greater understanding of the area under study. These observations were recorded in the preliminary evaluation stage of the research, and were later used in the shaping of appropriate models and hypothesis.

4.7 Visual Observations of Area

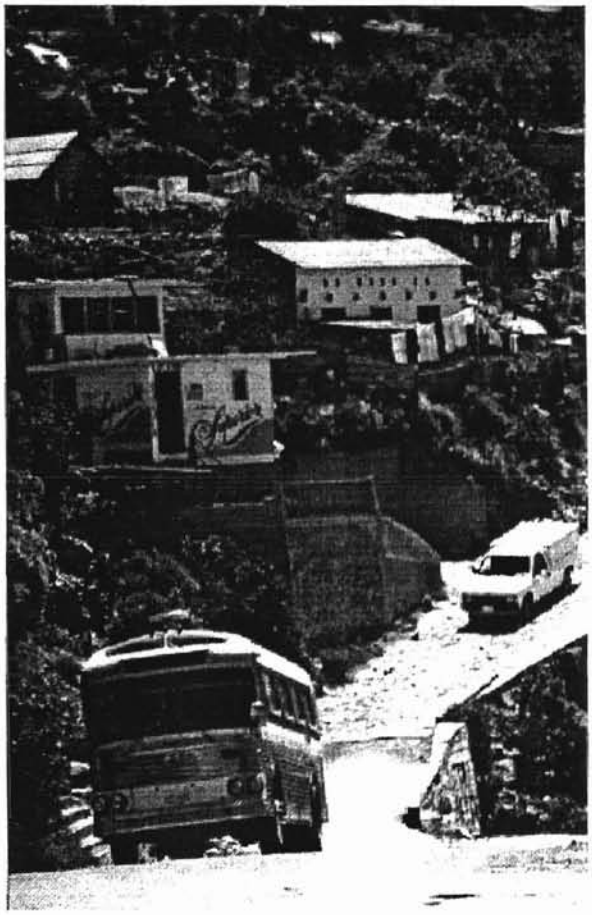
The first part of this evaluation, conducted as a preliminary evaluation, was the visual survey. This activity involved a detailed observation of each town, its economic and agricultural activities, natural and fiscal resources, and other distinct characteristics.

The results from these observations are separated by village and presented in the following sections.

4.7.1 Emiliano Zapata

Zapata is a small town saddling a small ridge alongside Cerro Tlacoxolo. It is accessible by a paved road of questionable quality and is approximately 20 minutes from Xicohténcatl. It is serviced by regular buses which pass approximately every 10-15 minutes and pass through the industrial corridor on their way to Apizaco, about 35 minutes away. A trip to Apizaco by public transportation currently costs 19 pesos round trip, or approximately $2 U.S.

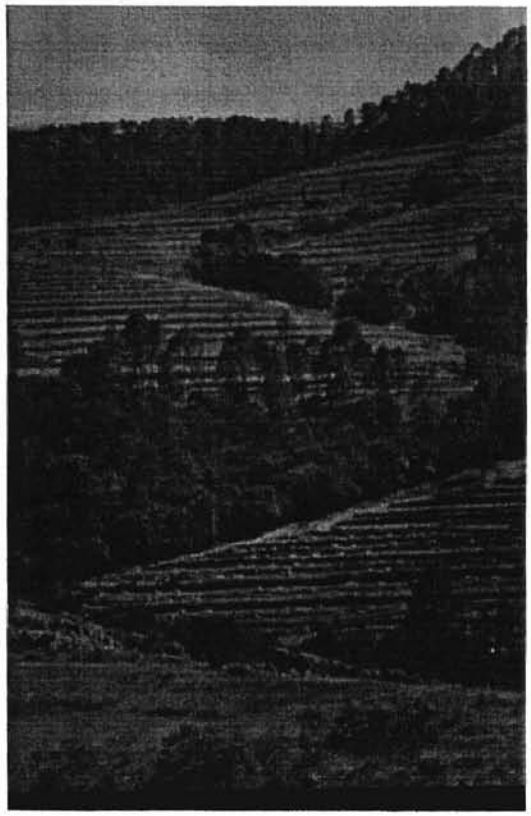
Image XI: Highway entering Zapata.



The public services are quite advanced, with primaría, 'telesecundaría', and a prepatoría all located within the village. In addition, there are two recreational areas including the basketball courts that have been constructed in the main plaza and a soccer field on the outskirts of town. Electricity and running water are present, though the water only runs every 3-4 days, and must be stored in household tanks in the interim.

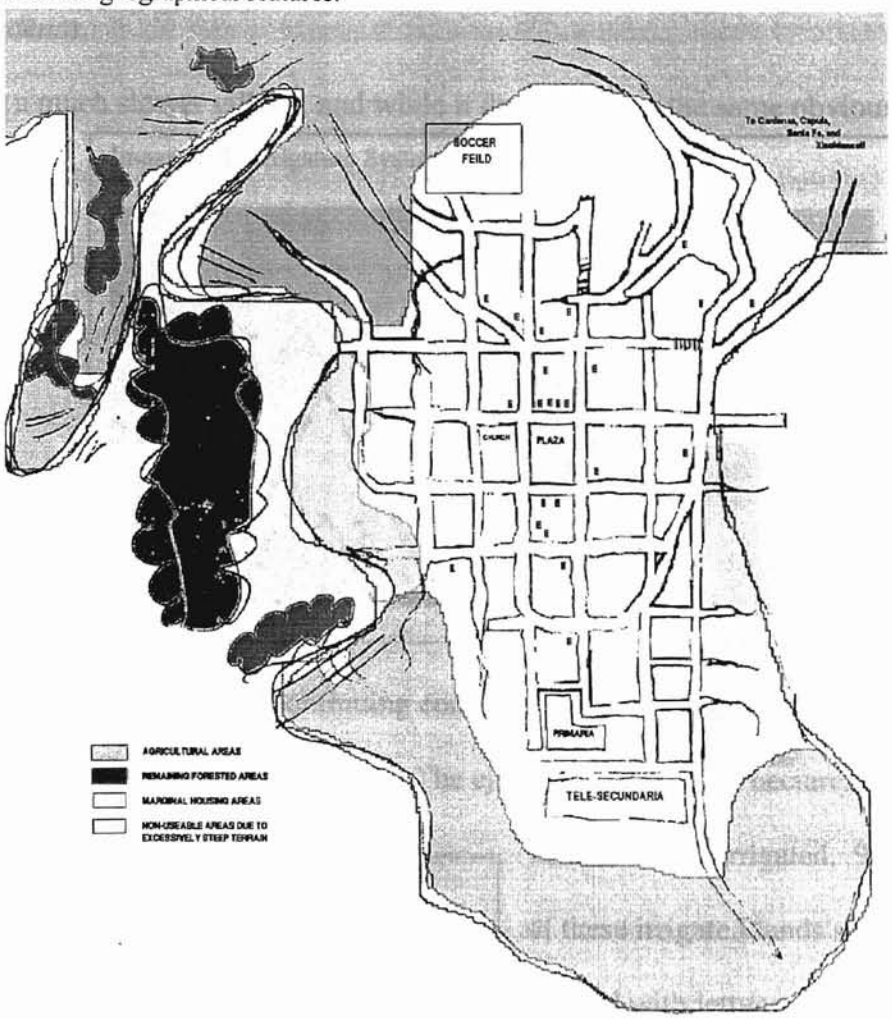
Economic activity was present in the form of small businesses throughout the own, 30 - 40 sewing workshops, a small logging industry run by the ejido on public lands, and the extensive agricultural sector. The attached map (Map V) is marked to indicate locations of small businesses and sewing workshops. This map indicated that there are 14 total establishments, a grouping that includes miscellaneous stores, restaurants (2), butcher shops (2), and a pharmacy. These establishments provide for the majority of basic needs, making trips to Apizaco unnecessary. The presence of sewing workshops also provides a respectable quantity of off-farm employment to the young women of the village, reducing the need to commute to Xicohténcatl.

Image XII: Terraces on flanks of Cerro Tlacoxolo before planting season.



Much of the surrounding land has been cleared for agricultural use. However, due to the steep nature of the surrounding geography, terraces are extensively used to increase arable land area. Corn is the principal crop, although haba and potatoes are also quite common. Agricultural animals are generally restricted to those which can be cared for in the patio setting, such as turkeys, chickens, pigs, goats, and sheep. There is also a fair presence of work animals such as burros, mules, and small horses.

Map V: Emiliano Zapata including public services, land distribution, and relevant geographical features.



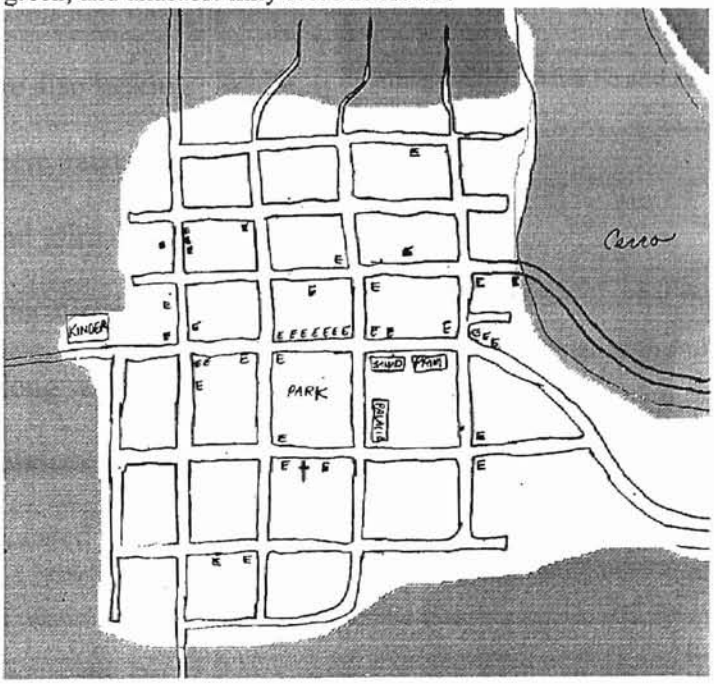
Poverty is most extensive along the edges of the village. As the village is geographically situated on the relatively flat top of a ridge, it is the village edges which are placed on the steep sides of the ridge (Map V). These areas are much too steep for the construction of roads, and are accessible only by narrow footpaths. While the majority of the homes in the central part of the village are constructed of concrete or adobe, the outlying homes are pinned together from twigs, bark, and tar paper. These areas have a much higher concentration of agricultural animals than the more developed central areas. The large sheep and goat herds in these areas are often accompanied by children. On a whole there are more children present in these areas during school hours than in the central areas, indicating that a smaller portion attend school.

4.7.2 *Lázaro Cárdenas*

Cárdenas is a much slower village, and while it does not have the same obvious levels of economic activity, the irrigated agricultural lands provide for a prosperous economic base. The recent construction of new playground equipment in the plaza and continuing construction on the large presidential palace are impressive testaments to this resource. The ejido consists of 550 hectares, of which 410 are irrigated. 90% of these irrigated lands are planted with lettuce, betabel, or carrots rather than the traditional subsistence crops. On those lands which are planted with corn, haba, and potatoes, the yields are much higher than those in surrounding communities.

Image XIII: Irrigation Systems on newly planted parcel.

Map VI: The village of Cardenas with agricultural areas in green, and unusable hilly areas in brown.



Several small stores

are scattered through the town, including among them two restaurants and a game room. A local tortillería mills the local corn production and provides machine made tortillas to the community. An estimated 70% of the population meet their weekly corn requirements through tortilla purchases. In addition, the town houses a health center, veterinarian, tire repair shop, shoe store, office supply store, and gift shop. It also has the services of a local elementary school, a telesecundaría, and is planning a prepatoría. The distribution of these services is indicated on the attached map, which includes small businesses, public services, and agricultural activities (Map VII). There is one sewing taller in the village which employs on average between 5 - 6 young women, but the industrial corridor is the primary source of off-farm employment.

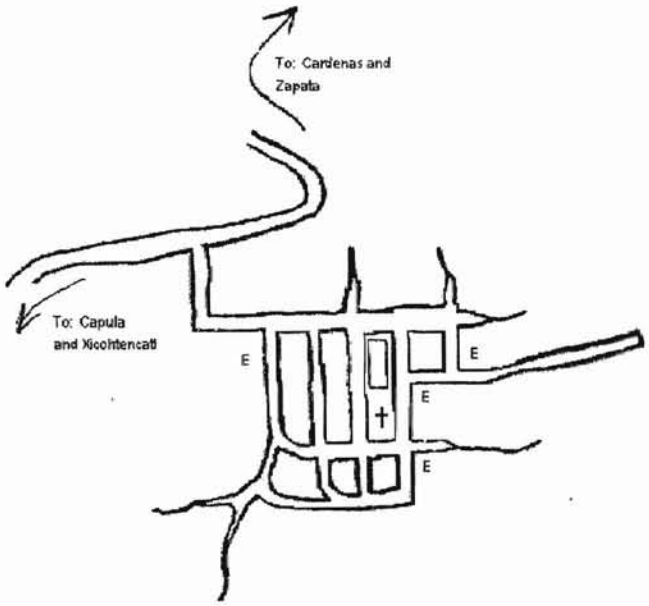
4.7.3 Santa Fé La Troje

Santa Fé is a small village with very little in the way of services. Five general stores and its agricultural sector make up its economic base. Accordingly, social services are also lacking. While there exists a kindergarten and primaría, additional educational services, along with health services, are absent. Located within walking distance (approximately ¼ mile) from Capula, the majority of its needs can be met in the larger village.

Image XIV: Santa Fé and surrounding agricultural areas.

The village itself is approximately 29 years old, and its formation began shortly after federal land distribution programs converted the seized lands of the area, which at one time were part of a large ranch, into communal properties, redistributing them by way of the ejidal program. Over the next 10 years parcel recipients slowly migrated to the small village and began to build their homes and lives there. One woman, who arrived 25 years ago, recounted that the village only consisted of three other households when she arrived. It was without water and electricity. While the town is still quite small, and the majority of the roads consist of dusty paths unsuitable for and unused by autos, it has grow rapidly in the past twenty-five years (Map VII).

Map VII: Map of Santa Fé indicating locations of economic and social services.



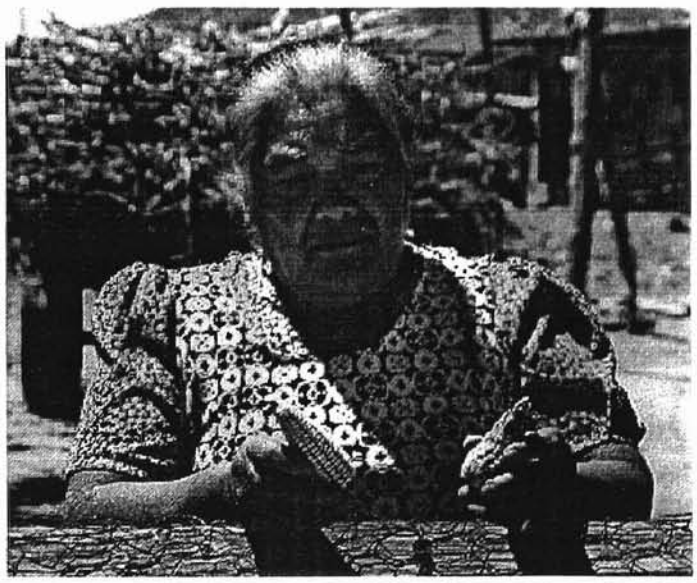
The agricultural sector is resource poor. There is no irrigation and soil humidity is low. Accordingly, livestock activities are limited due to the lack of forage, and in general do not exceed the amount that can survive off the residue from household corn production (the residual corn stalks are known as 'zacate', and take the place of hay in many Mexican production systems). In general, each hectare of corn will yield enough zacate to meet the consumption needs of one large agricultural animal (milk cows and mules are the preferred animals). Sheep and goats may also be kept, however,

their nutritional requirements are generally met by grazing. In years of late rain, water resources may not even be sufficient to meet the drinking requirements of the animals. In recent years cases are recounted of villagers who had to give away their small flocks of sheep or goats to keep them from dying of thirst.

4.7.4 Capula

Capula is one of the larger communities included in the study with a population of approximately 1500 people. Despite its size, it has little in the way of economic services and activities. While 21 general stores are scattered throughout the village, the commodities provided are minimal in their selection. There are no pharmacies, restaurants, or any type of specialty services. Basic social services are present, including a health center staffed by a student doctor. A primaría and telesecundaría are located in the town, however, if a child is to continue his education at the level of prepatoría she must commute either to Zapata or Apizaco.

Image XV: Capula woman showing the stunted ears which were found among 1998's crop residues from the lost harvest.

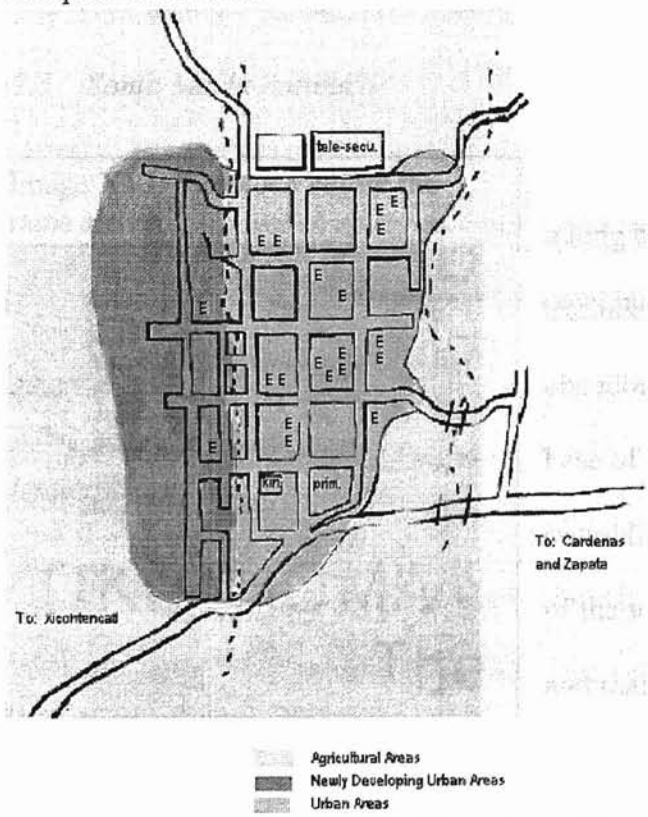


The agricultural sector is purely temporal, and agricultural animals are scarce. Livestock normally consists of poultry (chickens and turkeys), and work animals (horses, mules, and burros). While producers indicate

that they prefer to rent a tractor if money permits and one is available, land preparation with work animals is more common in the village. On average they indicated that working the land with an animal tended to adsorb three times as much labor as the same work done with a tractor.

The rain-fed nature of these agricultural lands can make survival very difficult for many of these families. The late rains of 1998 resulted in a complete loss of production for some producers. As the majority of these producers are subsistence farmers, the lost production resulted in a food shortage for the 98-99 season. In families where literate youth labor was available, the children have compensated for this lost production with industrial wages. In other families the adult and elderly males have sought work as laborers to fill this gap. In addition many families have removed meat from their diets, finding it necessary to sell their agricultural animals (such as pigs, sheep and goats) at the time of slaughter and reinvest the earnings in cheaper commodities such as corn and beans.

Map VIII: Village of Capula with agricultural areas, urban areas, and developing areas indicated along with the distribution of economic and public services.



While this temporal nature of the agricultural sector has caused extensive suffering among the people, the town does have potential resources for irrigation. Due to its location in the valley, the town is divided by two 'barrancas' or dry gullies which fill with water in the rainy season (see Map VIII). The town has evaluated the possibility of damming one these gullies to collect water in the rainy season and utilize the next year as irrigation water, much as the town of Cárdenas has done. However, due to concerns over possible flooding if the dam were to become compromised, it was decided that this option was not acceptable for this community.

4.7.5 Santa María Zotoluca

Image XVI: Zotoluca before the rains arrived.

Zotoluca, approachable only by way of a long one lane gravel road, was almost excluded from the study as it appeared abandoned on first arrival. A small town at the base of a small hill, it is encircled by a crumbling adobe wall. The debilitated nature of the village gives it the appearance of ruins, and many of the homes are without doors or windows. The town consists of one street approximately two blocks long with houses along both sides. There is one small store which sells cold pop, vegetables, some household supplies, and a small assortment of candies. Two other small stores are

limited to the sales of cold pop. There is a kindergarten and an elementary school in the town. However, studies beyond this level involve a small bus ride to a nearby community, and many families cannot afford the daily fare.

The town itself dates back to the turn of the century, and originated as the Hacienda Zotoluca. In the early 1980's the owners voluntarily distributed the remains of the housing complex along with the agricultural lands to the residents and employees of the hacienda, creating the small agricultural village of Zotoluca. Due to this unique method of creation, there was no ejido for the small town, and all land ownership is 'particular' or privately owned. Much of the land to the north is owned by two large ranches, Rancho Seco and Piedras Negras, and the majority of the private plots are located directly to the east.

All agricultural plots are temporal, with no available resources to dedicate to irrigation alternatives. However, in this community, the lack of water is not the only agricultural issue, as in many other communities. Due to the overuse of the maguey plant, which due to its wide shallow root system is traditionally used in lining terraces to protect the soils, the terraces of this community have been widely damaged. The loss in terracing has increased soil erosion, and results in greater water shed of rain falls. This lower adsorption and soil humidity, along with the loss of topsoil has resulted in a significant reduction in arable lands, with some producers reporting losses nearing 50%.

4.8 Conclusion:

With the goal of understanding the framework in which the communities under study are placed, the background material has evaluated the political, economic and

social background of the country as a whole, and of the region in specific. The historical framework of Mexican economic and political development and its specific impacts on agricultural and industrial policy were addressed, along with the specific region under study, thus providing a basic understanding of its industrial and agricultural development and existing social and production structures.

With this general background provided of the economic, political, industrial, agricultural and policy environments encountered in the region under study, the next step is to begin addressing the issue at hand – that of specific NAFTA impacts upon these communities. It is felt that to accurately evaluate the impact of NAFTA on these rural communities, a more robust view is needed than that of simple agricultural-industrial interactions. To complete this purpose, the following chapter conducts a complete analysis of NAFTA and Mexican agriculture, including its hypothesized costs and benefits, both in social and economic terms.

5. NAFTA AND MEXICAN AGRICULTURE

The North American Free Trade Agreement, which was signed in December of 1992 and went into effect in 1994, is the most extensive free trade agreement short of a common market ever negotiated and is unique in its inclusion of both developing (Mexico) and industrial (Canada and U.S.) nations. This agreement is the first of its kind between nations with such extensive cultural, social and economic differences, and many fears have been expressed on the part of all countries involved as to the outcome of this integration. In particular, Mexico has feared that its small proprietorships, manufacturers, and agriculturists will be unable to compete against the large American and Canadian firms with their seemingly unlimited access to capital and ability to exploit existing economies of scale (Barajas, 1993).

This difference is particularly strong in the agricultural sector, and its inclusion in NAFTA has not been without debate. Desires to protect this sector for a variety of economic and cultural reasons have resulted in a long history of exclusion for the agricultural sector from past free trade agreements. This sector is seen as one the most vulnerable in the NAFTA agreement. The following section evaluates the differences that separate the Mexican agricultural sector from its northern trading partners and the significances these differences will have in NAFTA.

5.1 Diverseness of Agriculture

The agricultural sectors present in the United States and Mexico vary widely in their characteristics. In most cases, this variation places Mexico in the position of comparative

disadvantage. Three major characteristics define the gap between Mexican and U.S.-Canadian Agricultural systems. According to Calva (1994), this disadvantage is principally due to:

1) La brecha tecnológica respeto a los países del norte.
2) Nuestra inferior provisión de recursos naturales.
3) Las diferencias en las políticas agropecuarias de fomento, caracterizadas en Estados Unidos y Canadá por la canalización de enormes apoyos y subsidios al sector primaria.[1]

Each of these characteristics is important in the understanding of how these vastly different agricultural sectors may interact under the influence of NAFTA, and is evaluated in more detail below.

5.1.1 Differences in Technological Implementation:

Firstly, the immense nature of the technological breech separating U.S. and Mexican producers must be noted. According to Calva, the labor productivity in the United States is more than one hundred times greater than that in Mexico due to this great discrepancy in respective levels of technological implementation (1994). The following chart evaluates differences in technological availability across Mexico, the United States, and Canada (Table I). This difference manifests itself in the Mexican production system as an extensive implementation of both manual and animal labor, resources virtually

unused in the American and Canadian systems. In the face of NAFTA's market opening decrees it is seen as highly unlikely that the small Mexican producer, who is still relying upon animal labor for land preparation and harvesting by hand, will be able to effectively compete with the large American and Canadian producers and their extensive

Table I: Rates of technological implementation in Mexico, the United States, and Canada.

	Mexico	United States	Canada
Number of tractors per worker	0.02	1.5	1.6
Number of harvesters per thousand workers	2	209	332
Quantity of fertilizer applied per worker	191.9 kg.	5.812 ton.	4.574 ton.
% of lands planted with improved seed	20%	100%	100%

Source: Calva, Jose Luis. "Rasgos del Modelo Agricola Neoliberal." *Alternativas para el Campo Mexicana* " Ed. Jose Luis Calva. Mexico: Distribuciones Fontamora. 1994.

mechanization. As significant as this difference is, it is not the only defining characteristic separating the Mexican agricultural system from its northern neighbors.

5.1.2 Differences in Natural Resources:

The difference in quantity and quality of natural resources in the agricultural sector also varies considerably across these three nations. The following chart evaluates the difference in agricultural resources on a per worker basis (Table II). These numbers

[1] 1) The technological breech with the northern countries. 2) Our inferior provision of natural resources. 3) The difference in formational agricultural policies, characterized in the United States and Canada by enormous subsidies to the primary sector.

reflect the trends towards small parcels distributed among large numbers of producers in Mexican agriculture, and extremely large parcels manages by a small number of agricultural workers in the northern counterparts. In addition to quantity differences, it is also important to note that the quality of agricultural lands in the U.S. is remarkably different from that of lands utilized in Mexican agriculture. Topographical problems in a large majority of Mexican arable lands result that they do not easily lend themselves to mechanization. Many of the basic grains are also better suited to the climactic conditions

Table II: Agricultural resource endowments in Mexico, the United States, and Canada.

Resource quantity (hect.) on a per worker basis:	Mexico	United States	Canada
Irrigated lands	0.6	5.9	1.7
Pasture lands	8.1	79	68.9
Forest resources	5	86.7	754
Total arable lands	2.7	61.4	97.4

Source: Calva, Jose Luis. "Rasgos del Modelo Agrícola Neoliberal." *Alternativas para el Campo Mexicana*." Ed. Jose Luis Calva Mexico: Distribuciones Fontamora. 1994.

present in the northern latitudes. It is important to note that both the lack of adaptability to technology we saw in the previous section and these differences in climate are most damaging to Mexican grain production. Other crops such as fruits, vegetables, and florals are not only better suited to many regions in Mexico than to the northern regions, but are also better suited to the lack of technological implementation. These are crops that are widely cared for and harvested by hand, even in the United States and Canada.

While some areas of Mexico may claim the comparative advantage in fruits and vegetables, there remains a great portion of lands too dry or cold for these crops. These lands for the most part, are also drastically inferior to the northern lands in terms of grain production potential, leaving them with little advantage, and no practical use in the newly opened agricultural markets of NAFTA.

5.1.3 Differences in Agricultural Policies:

The third disadvantage faced by the Mexican agricultural system has been the historically lower level of government investment. U.S. and Canadian agriculture has enjoyed high levels of government sponsored research, extension, infrastructure improvements, credit programs, and marketing assistance. These indirect benefits, coupled with a long history of direct subsidies and price supports, have provided these producers with a distinct advantage. Mexican producers find themselves incapable of competing against such producers who have benefited from decades of investment. While U.S. programs have invested large amounts in the improvement of production systems allowing this sector to improve in efficiency, government assistance to the Mexican producer has come solely in the form of protectionist trade policies. This has resulted not in a more effective production system, but rather in inefficient shifts in the types of crops chosen for production caused by artificially high prices. Instead of placing producers in a better position for the increased competition associated with NAFTA, this type of support program has effectively served to handicap the Mexican agricultural sector.

5.2 Price Impacts of NAFTA

The agreement phases out existing tariffs over a 10 year period, and also alters the previous agricultural trade restrictions into tariff-rate quotas, and then over a 10 to 15 year period phases out the over-quota tariffs. This latter method applies principally to import sensitive products, and includes a majority of the crops produced by Mexico's subsistence farmers. These crops include corn, beans, and barley -- which have the following quota system for Mexican import: 2.5 mil. MT (US) and 1000 MT (Can), 50000 MT (US) and 1500 MT (Can), and 120000 MT (US) and 30000 MT (Can) respectively, and the following over-quota tariffs: 215%, 139%, and 128% respectively (Hufbauer, 1993). Over the first six years this tariff will be reduced by 24% of its base level, and the remaining tariff is then phased out in equal annual reductions.

As can be seen in the following chart, these tariffs have supported a great chasm between domestic and international prices in Mexico. In general, this has raised the price

Table III: Comparative Analysis of National and International Agricultural Prices (1992 dollars)

Product	Domestic Price	International Price	% Difference
Corn	236.6	137.6	72.0%
Beans	656.9	439.7	33.0%
Barley	257.9	202.7	27.2%
Tomato	1200	1687.99	-28.9%
Oranges	244.39	1610.32	-84.8%
Avocado	2251	6086.28	-63.0%

Sources: *Perspectivas de Comercializacion de los Productos Basicos*, Mexico, Secofi, 1993.

Manrrubio y Santoyo, *¿Es negocio el Campo?* Revista Agronegocios, 1992.

of basic grains in Mexico much higher than the world price, and maintained the domestic price of fruits and vegetables much lower. In fact, partial motivation for the Mexican governments agreement to these tariff reductions has been attributed to the need to provide cheaper grains and reduced food prices to the growing numbers of urban poor. This was supported by Fritscher with the statement that "la existencia de enormes excedentes alimentarios en el mercado mundial y la sobreoferta estadounidense de granos fueron factores que orillaron a tomar esta determinación, al permitir que el abasto nacional se nutriera de alimentos importados de bajos costos.[2]" (Fritscher Mundt, 1996) It is likely that the removal of tariff and trade protections would result in price reductions nearing 70% for corn, and 30% for other basic commodities such as beans and small grains. This policy, while favorable to consumers, will be disastrous to those basic grain producers dependant on market income for household subsistence.

5.3 The Case of Basic Grain Production

In the previous price, policy, resource endowment analysis, and technological evaluations, one production sector stood out as markedly disadvantaged in Mexican agriculture. The basic grain sector, encouraged and spread by protectionist policies, has flourished in less than perfect soil and climactic conditions, incapable of supporting t he necessary mechanization even if the investment capital had been available. This has made this sector incredibly vulnerable to NAFTA's removal of trade barriers. Fritscher states that "la agricultura mexicana, compuesta en su mayor parte por cultivos que

[2] The existence of enormous alimentary excess in the world markets and the oversupply of U.S. grains were factors that surrounded the making of this decision. allowing that the national commodity supply feed upon low-cost imported supplies.

implican altos costos, bajos rendimientos y un escaso potencial de mejoría en su capacidad productiva, es una de estos sectores poco promisorios de la economía mexicana. Ello es particularmente cierto en el caso de los granos básicos y forrajeros, que ocupan más de 68% de la superficie cosechada, cuyo proceso de expansión se debió a políticas protectoras vigentes en décadas pasadas."[3] (Fritscher, 1996).

The effects of this process can be seen quite strongly in the specific region under study in the present research. Tlaxcala, once dedicated to the cultivation of maguey, has rededicated the majority of its low-lying flatlands to the production of barley, or cebada. This shifts was tied to the price supports provided by protectionist trade policies and pressures from the local beer industry, and in part to barley's superior resistance to late rains and drought conditions compared to other crops.

For the most part, however, this change in production systems to the barely model was only artificially profitable due to policy variables, and was not physically or economically suitable for the area. This extensive shift in production systems will make the agricultural producers in this region much more sensitive to any NAFTA induced reductions in grain prices. The economic damages to these producers are amplified for two basic reasons, both directly attributable to the shift to barley production:

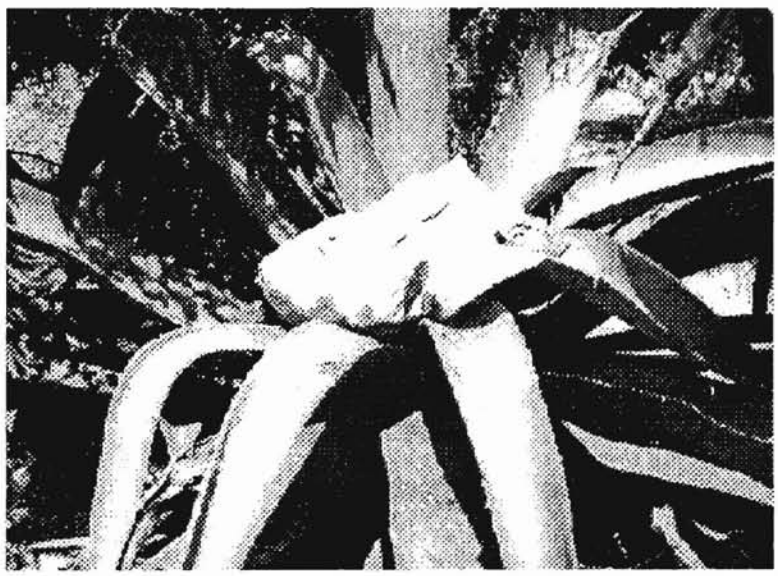
1) Increased environmental degradation, and
2) Increased dependence upon market income for purchase of subsistence commodities.

[3] Mexican agriculture, composed mostly of crops which imply high costs, low yields, and little potential for improvement in their productive potential, is one of the sectors in the Mexican economy which shows little promise. This is particularly true in the case of basic and feed grains which, forming more than 68% of the harvested acreage, owe their expansion to protective policies in past decades.

These elements are distinct in their effects, yet share a common direct cause. Firstly, we address the costs imposed upon producers in the form of environmental damages caused by the shift to barley production. The magueys traditionally planted in this area were characterized by an extensive shallow root systems. These roots protected the soils from the erosion associated with the heavy summer rains. As the maguey concentration was reduced due to the neglect and expansion of the artificially profitable cebada sector, the protection they once offered the fragile soils virtually disappeared. Producers within the area of study have reported losses of arable acreage nearing 70% as a result of the failing magueys.

Secondly, this shift has caused increased dependence upon market income for purchases of subsistence economies. As cebada is not a part of the production system indigenous to the area, these producers have shifted from a subsistence production system to a market based system. This means that their only source of subsistence is the monetary income received from the sale of grain. In a traditional system, in which maguey (used as a nutritional source as well as in the production of fiber and textiles) was cared for in

Image X: Maguey plant in central Tlaxcala being processed for nectar removal.



conjunction with corn and other crops for household consumption, there was very little market interaction. Much of the families subsistence requirements could be met from on farm production regardless of price fluctuations.

It is this increased market interaction and susceptibility to price fluctuations, coupled with the widespread loss of soils and acreage, that have made the shift to grain production a costly response to Mexico's protectionist policies. NAFTA's liberalization of these sectors will result in a painful price correction to an already crippled production sector. The following section addresses the social costs of this adjustment.

5.4 Social Costs of NAFTA in the Rural Sector

These changes in agricultural trade policy have the potential to greatly impact rural communities throughout Mexico. With 23 percent of Mexico's population functioning in the agricultural sector, any impacts in this area will have widespread implication. This sector of the population is also the sector least able to survive any negative repercussions with the GDP per capita in rural areas averaging slightly less than one fourth that of urban residents. (SARH, p. 13).

The difference in production systems and economic positions between U.S. and Mexican producers are obviously extensive and pervasive. While tariff reductions in the agricultural sector are spread out over a 15 year period in the NAFTA plan to reduce the shock associated with the merging of two such unequal systems, it seems unlikely that their merger in an open market system will be sooth or painless. Extensive price impacts are expected, which may result in widespread reallocations of human resources away from the agricultural sector. This has serious implications in an economy such as

Mexico's where high rates of unemployment haunt most regions. Adsorption of any excess labor spillover from a constricting agricultural sector will be difficult if not impossible. Calva has noted that "un proceso de concentración de la tierra podría desembocar en un éxodo rural sin destino, en una caldera social sin escape."[4] (Calva, 1994)

Another concern is that due to limited intersectoral transferability of lands, this human exodus will not likely be accompanied by a widespread reallocation of agricultural lands to other sectors. Rather, these lands will most likely be reallocated within the agricultural sector to larger producers with greater capital resources. Where land conditions permit, this increased concentration should allow for an implementation of new technologies and exploitation of economies of scale. However, when land condition are unsuitable for increased mechanization, such as those in nearly 2/3 of Mexico's agricultural lands (ibid), the process of land concentration without an associated increase in technological implementation would not result in any significant increases in efficiency.

Whether this process of land concentration among the remaining agricultural producers results in small increases in efficiency or not, the impacts upon the lower economic strata of the agricultural sector are likely to remain the same. It will be those producers with the least resources who will be forced out of the sector. Of those remaining, the producers with the most resources will be those with the capacity of taking advantage of the newly available lands abandoned by the failed producers. This concentration of land in the hands of those who already enjoyed the largest share of

[4] a process of land concentration could disembark a rural exodus without destination, in a social cauldron without escape.

income in the sector can only result in an exaggeration of existing income inequalities. In this manner, NAFTA is expected not only to result in a reassignment of rural poor to urban, equally poor areas, but also to effect a reassignment of income within the rural sector away from the absolute poor and into the hands of producers with greater original resources, income and potential.

The extent, however, of agricultural contraction and land concentration as a result of NAFTA is yet to be determined. It is likely that a variety of factors will play a part in determining the severity of this process. While price effects place pressures on the agricultural sector to contract, social and cultural ties binding producers to their homes, lands, and communities will provide counteracting forces. In addition, lack of alternatives will encourage producers to remain in the agricultural sector even at minimal profit levels. In fact, for those producers who have the option of producing the crops needed for household subsistence requirements, production is expected to continue even with a complete lack of monetary profit. This tendency towards production solely for consumption purposes is illustrated by Fritscher Mundt. This author states that the choice to plant corn over other crops is "más que una expectiva de elevados réditos, la elección de una vía que aseguraba la simple sobrevivencia del agricultor y su familia."[5] (1996). This indicates that even if the agricultural sector cannot provide profitable returns, production will continue as long as it can provide for household survival. This tendency may somewhat temper the effects of price pressures otherwise expected to contract the agricultural sector.

[5] the choice to plant corn over other crops is the choice of a path that assures the simple survival of the producer and his family, rather than a reflection of expected profits.

Social and cultural tendencies are not, however, the only factor expected to assuage the contraction process. It is also hypothesized by the current study that the creation and expansion of industrial corridors throughout rural areas could help provide supplementary employment and income to the agricultural sector, reducing migratory pressures and the need for producers to abandon their land. Other factors, such as government instituted transitional programs could also make a difference in the costs associated with the adjustment process. The government, limited in its financial ability to implement such programs, has fallen under criticism for its willingness to implement agricultural trade reforms without the accompanying transitional programs necessary to bring the social costs down to acceptable levels.

6. PREVIOUS LITERATURE

In evaluating the response of the rural Mexican household to changes in trade variables there exist several distinct methodologies. Surveys, interviews and oral biographies represent one approach that attempts to capture the opinions of those people who are living with these changes. Linear programming models, production function constructions, and econometric estimations are a second type of approach which attempt to apply mathematical models to the situation to evaluate sources of change and response patterns.

6.1 Survey approaches.

Most researchers have taken a survey route to quantify the household effects. Gladwin and Thompson utilized survey data in their 1995 multigenerational study in San Antonio Cacalotepec on the effect of women's work in the industrial sector on the overall quality of their lives. This study concluded that increased industrialization, and the associated increase in women working outside of the home, was related to reduced household poverty, reduced female poverty, increased liberation and empowerment of rural women, and increased female education levels. While this study did not take into account possible negative consequences such as low salaries, poor work environments, and increased workload for women, it did base its conclusions on their actual opinions regarding overall changes in their quality of life. They expressed, despite the widespread criticisms of the industrial treatment of Mexican women, that working outside the home had improved their quality of life as a whole.

Ytarte (1998) has analyzed the impact of industry in the community of Santo Toribio Xicohtzingo in the state of Tlaxcala, Mexico on workers and campesinos in the surrounding areas using tools such as oral histories and biographies. This approach also allows for an evaluation of the impact of globalization as seen and experienced by those affected most directly. This impact was seen differently by different people, as can be expected. Some saw the factories as a blessing during hard times to hold them over between harvests and in bad years, helping augment the families' standard of living. Others saw them as a fatal trap in which the worker was held in misery, working for a wage that was to low, yet being so dependent on that income that they could never quit.

6.2 Linear Programming Approaches

While this approach provides an effective and straightforward method to evaluate effects which are difficult to quantify, such as quality of life and the importance of changing social and production roles, they provide little information as to the specific impacts of trade liberalization on household production strategy. While they can quantify the end result and how the participants feel about that result, they cannot explain how that result occurred, and how that result will vary under different circumstances. For this reason, the present study attempts to combine the survey and interview data with a linear programming model to predict producer response under varying circumstances. The use of a linear programming model to predict producer response to changes in policy variable is an established economic method, and is well documented in literature.

Bezuneh et al. (1988) utilized a linear program model to assess a food-for-work program in rural Kenya. The principal analysis addresses how this policy affects the

allocation of household time between production and leisure activities. This model utilizes a profit-maximizing objective function despite the subsistence agriculture nature of the program. While the authors note that a production function approach is preferable, it is not as cost effective, nor does it facilitate sensitivity analysis. For these reasons a LP model was chosen as appropriate for analyzing the impacts of this program on the peasant household.

Epplin and Musah (1987) utilized a Linear Programming model for the Liberian subsistence farm family, and while the model was not designed to address any specific policy concerns, they did take a novel approach to one of the issues present in subsistence agriculture. As consumption requirements for key foods are generally met by household consumption, a restriction was introduced requiring on-farm production to supply a minimum quantity of these goods.

These models set precedence for the evaluation of policy impacts on subsistence farm households using a linear program model. Accordingly, the present study will utilize a linear programming model to estimate producer reaction to changes in trade variables. However, due to the model's inability to measure changes such as quality of life changes, this research will need to merge survey and interview data to gain a more accurate understanding of these changes. By combining personal interviews with the mathematical model, this study hopes to avoid the shortcomings presented by both methods when utilized independently.

7. METHODOLOGY

Situated within a framework of studies on both economic impacts of trade policy and sociological analysis, the present study seeks to link the economic theory of international trade with a socio-economic conceptual framework. In this manner, the conceptual framework builds from three related factors, which affect the outcome for any particular community. The first factor refers to the national and regional price response of agricultural commodities to changes in trade policy. The second factor addresses the changes in industrial demand for labor as a result of the said policy. The third factor, community and household structure, filters and combines the effects of the previous two. This refers to the actual community structure which is reacting to, and being affected by, the first two factors. It is the household response to these price changes which arises from a combination of economic, cultural, and environmental stimuli, and is exhibited by changes in various economic and social activities.

It needs to be noted that the three previous factors are expected to result in differential outcomes by community and household as differences in resource allocation, individual response patterns (such as livelihood strategies, long and short distance migration, and other types of labor force adjustments) and socio-cultural framework (such as traditional gender roles, and household composition) vary from household to household and from community to community.

Through this type of approach the economic and social impact of this policy will be evaluated, and the highly variable interaction between policy, economics and

sociological frameworks will be analyzed. This process will be derived from the following assumptions, which form the foundation of this research:

7.1 Assumptions

1. The principal economic manners in which the North American Free Trade Agreement has impacted these rural communities have been through price impacts in agricultural communities, and changes in industrial demand for labor.

2. Furthermore, it is hypothesized that this change in prices and labor demand has resulted in a distinct and measurable change in the rural household's production strategy.

7.2 Hypothesis

This study hypothesizes that increased industrial demand for labor has been associated with the North American Free Trade agreement. Furthermore it is hypothesized that this increased demand for labor has presented employment alternatives to residents of rural agricultural villages, reducing the need for migration in years of agricultural crisis (whether economic or climatic). Through this mechanism, it is hypothesized that increased industrialization has improved the viability of the agricultural sector. In addition, due to the subsistence nature of the majority of small producers, it is hypothesized that any negative ramifications of NAFTA on agricultural commodity prices has not caused extensive detrimental effects on the small subsistence producer, as

their production was never destined for the formal market, and therefore is immune to price changes.

7.3 Procedures

The objectives of this study will be achieved through a sequence of procedures. This will include both a data collection process through corporate and factory interviews to estimates changes in industrial demand for labor, a linear programming analysis at the producer level to estimate producer response to these changes, and a combination of survey information and in depth interviews to evaluate the social impacts of these changes (which will also result in the collection of the necessary data for the linear programming model).

To facilitate and focus the process of data collection, the study will be limited to rural communities surrounding the industrial corridor of Xicohténcatl in the northern part of the state of Tlaxcala. Due to the isolated nature of the area and population, preliminary surveys and interviews were conducted over a 6 month evaluation period in 1998. A two month period of intensive data collection was conducted in early 1999 which included interviews with producers at all levels of household production, in addition to industrial representatives.

Field research was conducted in 5 rural communities in the region with a principal focus on the small mountain town of Emiliano Zapata, and including supplementary data collection in the villages of Capula, Zotoluca, Santa Fé La Troje, and Lázaro Cárdenas. These communities were evaluated based on their differences in agricultural activities, labor migration, and natural resource endowments in order to have a sampling of

communities representative of varying conditions. An overview of general community characteristics is presented in Table IV. These characteristics demonstrate the wide variability in the socio-economic frameworks of communities in this area. This variety in the communities under study assisted in determining how these various external factors influence producer and community response to policy and macroeconomic changes.

Table IV: Summary characteristics of rural communities surrounding the industrial corridor of Xicohténcatl.

Pueblo	Population	Principal Crops	Irrigated Area	Agri. Structure	Labor Migration	Oth Econ Activities
Emiliano Zapata	6500	corn, potato, haba	10%	Ejido	Minimal	Clothing Fabrication, Logging
Lázaro Cárdenas	2700	lettuce, carrots, corn	74%	Ejido	Average	sheep
Zotoluca	300	small grains corn, haba	0%	Private	Extensive	-----
Capula	1500	small grains corn, haba	0%	Ejido	Average	-----
Santa Fé la Troje	400	small grains corn, haba	0%	Ejido	Extensive	Sheep

The survey and interview data that was collected in these villages in the interview stage was used in the creation of a linear programming model to estimate specific producer responses to estimated NAFTA related price and labor demand changes. This process required the construction of enterprise budgets for each commodity included in the production system, and indicated the usage and timing of inputs, including labor. Labor requirements are separated by gender to reflect the distinct division of labor in agricultural, domestic, and off farm economic activities, allowing the model to consider these factors in its prediction of farm response to changes in prices and other economic and environmental impacts.

7.4 Survey Activities

The initial stage of the data collection process included visual evaluation of economic and agricultural activities present and the completion of a simple questionnaire by locals in all five villages under study. This questionnaire provided basic data which was used in establishing the assumptions to be made by the linear programming model (see Appendix I). This data evaluated household composition, labor availability, pervasiveness of subsistence agriculture practices, crop compositions, and yield variations on lands with different resource bases (such as soils and irrigation).

Due to the isolated nature of these villages and the distrusting nature of many residents, survey data was difficult to collect. Total survey participants included only 20 households. The in-depth interviews with a small number of individuals with whom a trusting and open working relationship could be developed was the more effective data collection method, and the results seemed more dependable. Many people in the surveys

seemed unsure of their answers. For these reasons, the survey results were useful in providing general household data, but any results that conflicted with interview results were not used in the construction of model assumptions. The conglomerate survey results are presented in the following table, along with the dissaggregated results by village (Table V). These data indicated that a large majority of the area residents relied on agricultural production for a majority of their income (100%). Plot sized averaged at 4.25 hectares, of which 63% was planted in corn. The subsistence nature of these producers was reflected in that 80% of the corn harvest was destined for household consumption. This number is low only due to the influences of the towns of Lázaro

Table V: Survey results for Zapata, Cárdenas, Capula, Santa Fe La Troje, and Santa Maria Zotoluca

Survey Questions:		Aggregate Results	Emiliano Zapata	Lázaro Cárdenas	Capula	Santa Fé La Troje	Santa Maria Zotoluca
Household size		7.5	9.4	6.7	8.5	5.0	8.2
Gender composition							
	male	46%	37%	47%	53%	50%	42%
	female	54%	63%	53%	47%	50%	58%
Age composition							
	0-9	26%	20%	18%	28%	42%	22%
	10-18	12%	18%	15%	12%	0%	16%
	18-28	32%	20%	32%	36%	42%	32%
	29-up	33%	42%	35%	24%	33%	30%
Employment							
	campo	44%	32%	57%	45%	42%	45%
	household	41%	49%	43%	37%	42%	36%
	industry	7%	17%	0%	0%	0%	19%
	other	7%	2%	0%	18%	17%	0%
Weekly commodity usage (kilos)							
	corn	38.12	46.3	43	25	30	46
	beans	4.37	2.3	4.0	7	3.25	5.3
	vegetables	4.25	15.3	4.5	0	0	1.5
	meat	1.13	2.7	1.4	1	1	0
Land Ownership							
	Yes	100%	100%	100%	100%	100%	100%
	No	0%	0%	0%	0%	0%	0%

Table V (cont.): Survey results for Zapata, Cárdenas, Capula, Santa Fe La Troje, and Santa María Zotoluca

Survey Questions:		Aggregate Results	Emiliano Zapata	Lázaro Cárdenas	Capula	Santa Fé La Troje	Santa María Zotoluca
Plot size (hectares)		4.24	4	3	4.625	3.75	5.75
Crop areas							
	corn	63%	70%	22%	67%	88%	70%
	beans	16%	15%	21%	20%	13%	10%
	potato	14%	14%	---	---	---	---
	lettuce	44%	---	44%	---	---	---
	betabel	22%	---	22%	---	---	---
	carrots	17%	---	17%	---	---	---
	grains	18%	---	22%	13%	---	20%
Water availability							
	irrigation	0%	0%	0%	0%	0%	0%
	temporal	100%	100%	100%	100%	100%	100%
Yields (kilos/hectare)							
	corn	1479	1071	2500	1350	1250	1225
	beans	1865	775	5750	1000	1000	800
	potato	1560	1560	---	---	---	---
	lettuce	37500	---	37500	---	---	---
	betabel	33500	---	33500	---	---	---
	carrots	35000	---	35000	---	---	---
	grains	2728	---	2833	2750	---	2600
% for household use							
	corn	80%	100%	40%	100%	100%	60%
	beans	100%	100%	---	100%	100%	100%
	potato	100%	100%	---	---	---	---
Amount sold							
	corn	20%	0%	60%	0%	0%	40%
	beans	0%	0%	---	0%	0%	0%
	potato	0%	0%	---	---	---	---

Cárdenas and Zotoluca which due to varying resource bases (irrigation and large plot sizes, respectively), have overall yields which exceed family consumption needs. The other three villages included in the study produce on a purely subsistence basis. Due to the lack of credibility with much of the survey data, visual evaluations and interviews were used to confirm and complement questionnaire results and are presented in detail in the social evaluation section of the results.

One detail not clear in the above table regards the plot size of farmers in Santa María Zotoluca. Due to soil erosion and degradation in the terraces traditionally used for

farming on the steep hillsides, the actual amount of arable land is less than the total plot size indicated in the table. While the average total plot size ranged around 5.75 hectares, arable land was nearer 4.5 hectares per producer. This loss of plot size varied widely among producers, with some campesinos reporting losses nearing 50%.

7.5 Interviews

The in-depth interviews provided necessary data that was not available by visual observation or survey responses. Interviews were conducted with industry officials, community leaders, campesinos, housewives, and factory workers. These interviews not only provided necessary information regarding labor allocation for the Linear Programming model, but they also brought out many of the social and economic concerns of local residents. Some of these interviews were transcribed in their entirety, while others are only summarized in the results section. The information gathered from this process came from three different groupings of interviews. The first grouping includes industrial interviews, the second campesino interviews, and the third includes various interviews with rural women. This variety in the types of interviews conducted provided for a rounded picture of the industrial/agricultural interaction to develop.

The campesino interviews provided most of the detailed labor allocation data with respect to crop activities. Timing of soil preparation, fertilization, planting, weeding, tilling, harvesting, and food processing were all evaluated and are summarized in the following calendar (Figure V). In addition to the timing of production activities, the associated labor requirements were also discussed in detail for the construction of the enterprise budget. While labor requirements by activity have been somewhat aggregated

in the budget, the dissaggregated data is available in the following section. This is not a transcript, but rather a summarization of all applicable data collected with respect to crop production and labor requirements. The data was summarized from interviews which took place over a 6 month period with various producers. Whenever possible, the data was verified across producers for accuracy. This data was then utilized in the construction of the enterprise budgets and Linear Programming model, as discussed in more detail in the next chapter.

7.6 Notes from Producer Interviews.

Producer interviews covered all input requirements for the major crops produced in the area, focusing on labor. Labor requirements for the different crops were found to vary distinctively by type of production: rain-fed vs. irrigated, organic fertilizer vs. inorganic, and land preparation using tractors vs. animal power. As these production variations tended to affect the same type of changes to all crops, they are discussed first.

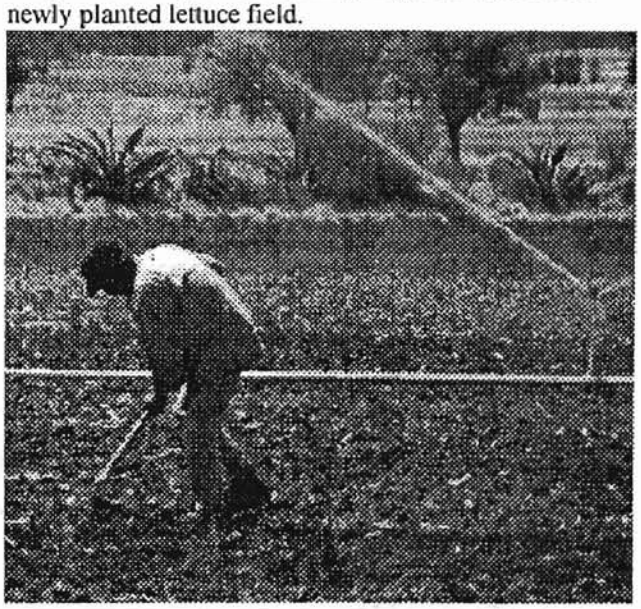
Irrigation tended to increase the amount of labor required, as the sprinklers had to be supervised and regularly rotated. The irrigation tubing usually consisted of approximately 18 individual tubes (cost per tube: $746, average life-span: 10 years), connected in one length. (Depreciation is calculated at approximately M$1350/year. Due to unanticipatable interest rates, inflation and other influential variable, this value is a straight-line depreciation.) This length needs to be moved to 7 distinct placements to irrigate a full hectare. Each placement lasts approximately one hour, and 20 minutes are needed to move the full tubing length into a new placement.

Figure V: CALENDARIO DE CULTIVOS POR EL AREA GEOGRAFICA DE XICOHTÉNCATL TLAXCALA. Los actividades realizados principalmente por hombres son en azul, por mujeres en rojo, y los que están realizado por los dos son en negro.

Actividad	E	F	M	A	M	J	J	A	S	O	N & D
			----------	----------	TEMPORADA DE LLUVIAS			----------	----------		
Cultivos											
cultivar los terrenos con tractor o yunta											
maíz			sembrar fertalizante deshierbar yunta	trabajar con el harado	deshierbar	trabajar con la vertadera	deshierbar	deshierbar	cosechar desojar	desgranar	
papa			sembrar	yunta	yunta	yunta	yunta fertilizante	cosecha			
granos básicos					siembran	----------	----------	----------	cosecha		
haba			sembrar	deshierbar	yunta	deshierbar	yunta	cosecha			
Cultivos de Riego:											
	cultivar los	terrenos con tractor o yunta									
lechuga, betabel y zanahorias	sembrar regar		deshierbar regar laborar	regar yunta	regar laborar deshierbar	regar yunta laborar	regar cosechar sembrar	deshierbar regar yunta	regar laborar deshierbar	regar yunta cosechar	

In total the irrigation of one hectare adsorbs the labor of 2 people for one nine hour day. The irrigation needs of the various crops are different, with crops such as lettuce, betabel and carrots needing irrigation every twenty days, and others only once a month (such as corn). Other crops only need irrigation at certain stages of their development (the haba and small grains receive irrigation in the germination stage, and the haba receives it again after reaching its flowering stage at approximately 2.5 months). The labor hours associated with the irrigation process, along with the cost of the equipment were resource requirements for crops grown on irrigated land in excess of those resource requirements for crops on temporal lands.

Image XI: Campesino working irrigation waters into newly planted lettuce field.



Labor requirements and capital investments also varied across production systems utilizing either organic or inorganic fertilizers. For those producers using organic fertilizer, a part of their needs could be met by household production. On average each household had two large agricultural animals such as mules, horses, or cows. Each animal has the capacity to produce one truckload of organic fertilizer per year. Each fertilization activity requires approximately 10 truckloads/hectare (some crops require two fertilizations in the growing period). Additional truckloads can be purchased at a price of $100 pesos/truckload. The organic fertilizer is quite bulky and requires

approximately 6 labor hours to spread over one hectare. In addition it can take up to three days to transport all the necessary material to the site. This results in a total of 24 labor hours/hectare, plus the cost of any purchased abono for each act of fertilization with organic fertilizers.

Inorganic, or chemical, fertilization involves quite a different set of resources. Approximately 2 ton of chemical fertilizer/hectare is required for each act of fertilization. This must be purchased, and is available at a price of M$1100/ton. This can be delivered to the field site in 3 hours, and distributed over one hectare in 3 hours, resulting in a total labor requirement of 6 labor hours/hectare.

Image XII: Corn field being prepared for planting with use of animal power.

The type of power used in land preparation also affects labor requirements. If the land is prepared (barbecho) by tractor, this service is generally contracted for a price of M$400/hectare. Household labor requirements for this activity is generally limited to 2 hours/hectare. However, if the land is prepared by animal power, labor, rather than capital, is the principal resource. In general, animal powered field activities take 3 times the amount of human labor as those conducted by machines. This holds true for the barbecho con yunta, which generally requires 7 labor hours/hectare vs. the two required for the tractor.

While these variations in production methods affected labor and resource requirements, there was also variation across crops. The principal activities present in the crop calendar include: barbecho (land prep.), sembrar (planting), desaijes (weeding), fumigation, fertilizations, meter la yunta (row tilling with mule), irrigation (when available), laborar (detailed revision of crop), and the cosecha (harvest). The number and timing of these activities varied by crops, but for the most part the requirements for one hectare of fertilization or desaije or irrigation, were the same across crops. Two distinct exceptions to this rule are the activities of planting and harvesting, which have distinct requirements for each crop.

The planting activity for lettuce, betabel, and carrots involved double the labor requirements as other crops due to the need to pass the mule through the field twice, once for tilling before depositing the seed, and afterward to 'tapar' or cover the seed with soil. While planting activities for one hectare of maiz, and other crops only required the labor of three people for six hours (18 hours/hectare), lettuce, betabel, and carrots required 30 hours/hectare.

Harvest requirements also vary widely by crop. Lettuce, betabel and carrots require 4 people working for two days, or 48 hours/hectare. Haba, on the other hand, requires 15 people working one day to harvest one truckload of 4 tons (22.5 hours/ton). These harvesting requirements for haba are presented by ton, as yields vary on rain-fed and irrigated lands, harvesting requirements will also vary. Small grains, such as barley, oats and wheat are not harvested manually, but rather contract machine harvesting for M$350/hectare.

Other activities do not exhibit as much variation across commodities, and one general requirement can usually be fitted to the specific needs of each crop. The requirements for each unit of activity that has not been previously discussed are listed as follows:

1) Fumigation: M$110/hectare.
2) Desaijes: 60 units of household labor.
3) Meter la yunta: 6 hours / hectare.
4) Laborar: 6 hours / hectare.

While each unit of activity may entail the same resource utilization, different corps need different timing and levels of activities. Over a four and a half month growing season lettuce, betabel, and carrots require barbecho, planting, two desaijes, three laboras, two fertilizations, 3 uses of the yunta, 6 fumigations, 7 irrigations, and finally the harvest. Small grains, however, only require barbecho, planting, 1 fumigation, 1 fertilization, 2 irrigations (when available), and harvest. Corn requires 1 barbecho, planting, 2 fertilizations, 2 laboras, 4 desaijes, 5 irrigations, and the harvest. In addition, corn

Image XIII: Shucked corn drying on a rooftop awaiting the removal and processing of the grains.

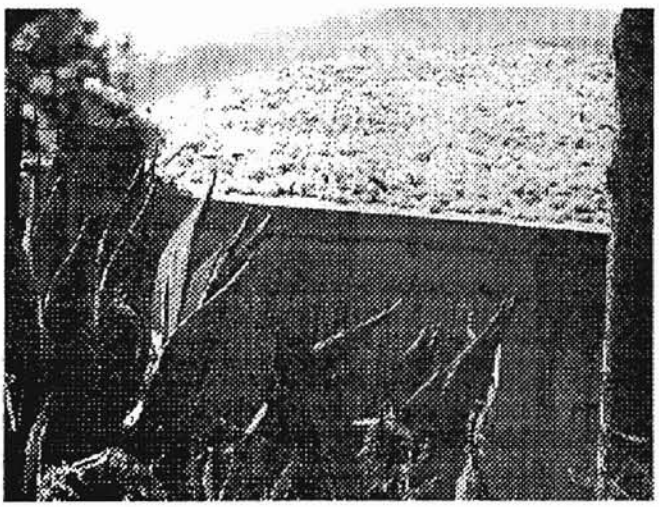


Table VI: Production activities separated by crop.

CROP	ACTIVITY							
	barbecho	*planting*	*fumigation*	*fertilization*	*desaijes*	*laborar*	*yunta*	*harvest*
Lettuce	1	1	6	2	2	3	3	1
Betabel	1	1	6	2	2	3	3	1
Carrots	1	1	6	2	2	3	3	1
Small Grains	1	1	1	1	0	0	0	1
Corn	1	1	0	2	4	0	0	1
Potatoe	1	1	4	2	0	0	4	1

requires further processing, including the process of desojar (in which the shucks are removed), drying, and the removal of seeds. Haba requires barbecho, planting, 2 desaijes, 5 irrigations (when available), 1 fumigation, and harvest. The potato requires the barbecho, planting, 2 fertilizations, 4 fumigations, and 4 uses of the yunta which replace the manual weeding process (desaijes) for this crop. The harvest requirements are extensive, and for one hectare, twenty people are needed for two days.

It is important to note that the requirements for lettuce, betabel and carrots are listed for one crop. On the irrigated lands, these commodities can be planted twice a year, resulting in two crops annually. They can either plant the same commodity twice, or rotate among commodities during the two available planting seasons.

In addition to labor and capital requirements, yields also vary across activities. Producers indicate that organic vs. inorganic fertilizers does not noticeably affect yields, except in that there is more room for error with the organic methods, reducing damage with over application. The greatest difference is between irrigated and rainfed lands.

The following table demonstrates the yield differential between irrigated and rainfed lands for those crops which are produced on both.

Table VII: Yield differentials on irrigated and temporal lands.

Crop	*Yields (ton/hectare):*	
	Rainfed	Irrigation
Corn	1.5	3
Haba	1	6
Potatoes	2.5	9
Small Grains	2.5	3

These yield variations are taken into account by the linear programming model, as well as variation in labor and other resource requirements across productions methods such as irrigation vs. rainfed, organic vs. inorganic fertilizers, and mechanical vs. animal powered land preparation.

Due to the extensive use of agricultural animals in production methods, it was also necessary to evaluate their requirements. In general, 12 hours/animal monthly were sufficient to collect any abono produced for later use or sale, put the animal out to pasture in the rainy season (when vegetation is available), and to provide food and water daily. One animal is assumed to require the zacate from one hectare of corn, supplemented with 15 bales of small grain hay annually.

This information was all collected from producer interviews, and was verified across producers and against field observations for accuracy. This process insured accuracy of the data, and insured that it reflected the actual production practices specific to the region under study. These data on production practices, requirements and yields

provided the raw data needed for the construction of the linear programming model. The following chapter specifically addresses how these activities were incorporated into the model, the resources required for each process, and the restraints that applied to these activities.

8. LINEAR PROGRAMMING MODEL

The empirical model used to evaluate producer response to policy variable changes analyzed on production components. This decision is based on the assumption that markets exist for all goods and labor, and that price is exogenous to the household production activities. Due to the nature of Mexican commodity and labor markets, and to the relatively small size of the household unit, it is felt that this assumption is a reasonable one. Household, for the purposes of this study, is defined as those people within the same living unit, regardless of relation. The living unit itself is typically composed of several living areas which house distinct nuclear families which are generally incorporated into one unit by way of a shared patio area. In general the living unit is composed of a large portion of the extended family, with grown children and their families occupying the small separated living areas within the unit. Food, financial, and land resources are often shared, resulting that this large extended family functions as one single economic unit.

The farm household is assumed to allocate its available resources (land, labor, and capital) to maximize its returns. The following equation summarizes the objective function:

$$P\ [f(X_1 .. X_n)] = C_1X_1 + C_2X_2 + \ldots . C_n X_n$$

Where:

P = net capital returns in new pesos,

C_{1-n} = capital returns per unit of activity 1-- n.

X_{1--n} = level of activity 1-- n.

These activities, transfers, and associated constraints are discussed in more detail in the following sections. All activities and production data were collected in surveys, interviews, and from local observations. This involved a detailed observation of each town, its economic and agricultural activities, natural and fiscal resources, and other distinct characteristics. The results from these observations allowed the forming of model hypothesis, and provided a basic understanding of the area, processes, and issues present.

All villages and agricultural areas were accessible to transport, although many roads were of questionable quality, with some nearly unpassable. This factor is important in providing access to the formal market for those producers who sell their production. All villages were also serviced by regular buses that pass through the industrial corridor on their way to Apizaco, about 30 minutes away. This is vital in providing mobility to the workforce, and permitting active participation in both the agricultural and industrial sectors.

Services are varied from village to village, with some villages providing educational and medical services, some relying on a large variety of merchants, and some without running water and telephone. The majority of villages did not have the services of a tortilleria, indicating that the women's labor supply in the model would need to be reduced for the demands of hand making the families daily requirement of tortillas. Some villages had sewing talleres present within the village, which employ local young women, but the industrial corridor is the primary source of off-farm employment.

Apart from Lázaro Cárdenas, the agricultural sector on average is resource poor. There is no irrigation and in most villages soil humidity is low. Accordingly, livestock

activities are limited due to the lack of forage, and in general do not exceed the amount that can survive off the residue from household corn production (the residual corn stalks are known as 'zacate', and take the place of hay in many Mexican production systems). In general, each hectare of corn will yield enough zacate to meet the consumption needs of one large agricultural animal (milk cows and mules are the preferred animals). Sheep and goats may also be kept, however, their nutritional requirements are generally met by grazing.

While producers indicate that they prefer to rent a tractor if money permits and one is available, land preparation with work animals is more common in the village. On average they indicated that working the land with an animal tended to adsorb three times as much labor as the same work done with a tractor. This was included in the model, with the varying costs and labor requirements, to give the model the same realistic alternatives present within the communities.

In addition, specific production activities and requirements, as well as yields and input requirements were collected in this stage of the research. Prices were collected from a variety of published sources, and cross-referenced with producer interviews to assure accuracy of the data. The end result was the Linear Programming model used to evaluate the effect of estimated NAFTA induced price shifts. This model is evaluated in detail in the following sections, beginning with the activity columns.

8.1 Activities:

The following figure, which describes all available model activities for labor allocation shows four major categories, some of which are aggregated in the model, and

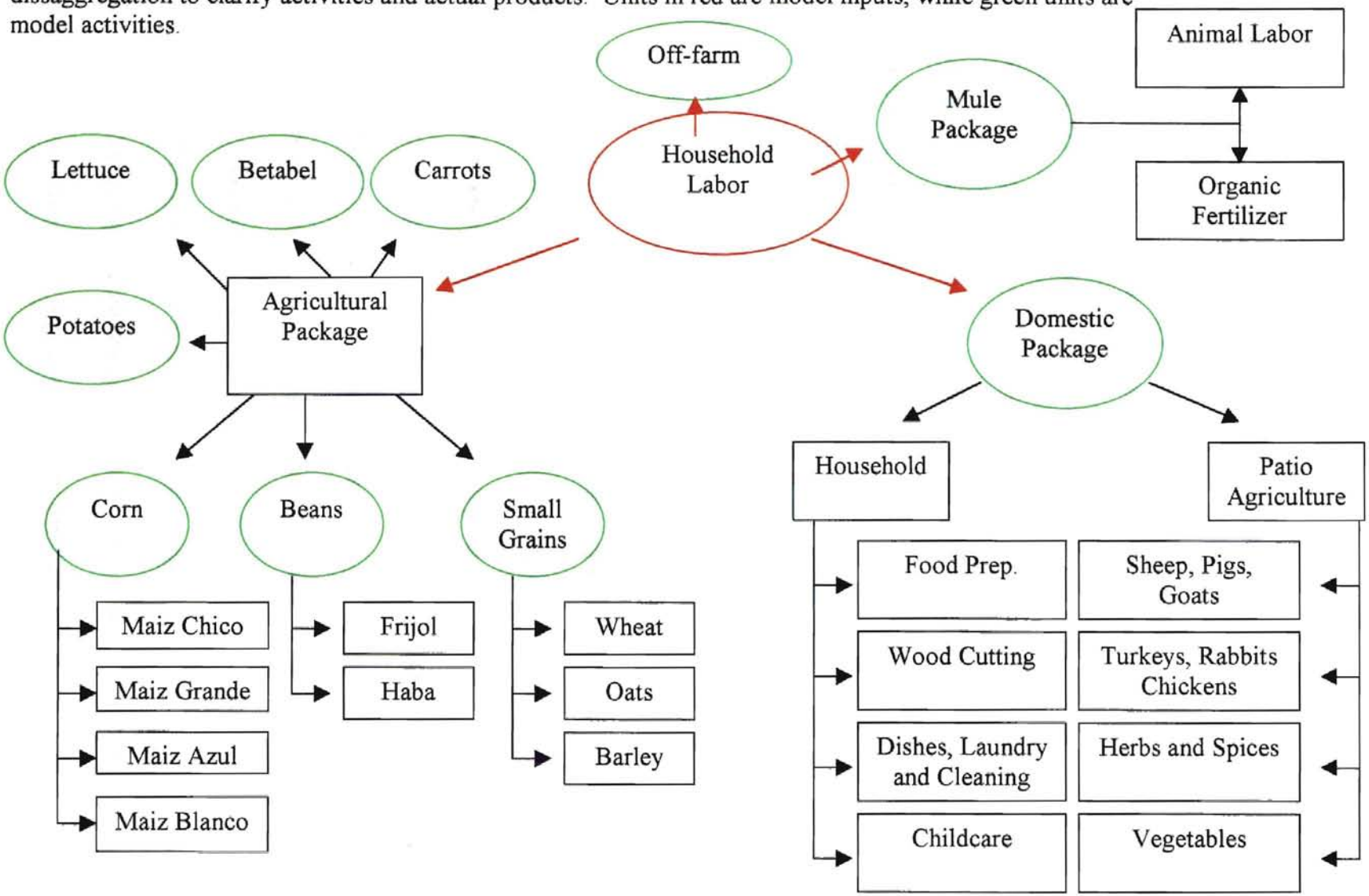
others which are evaluated independently (Figure VI). These categories consist of agricultural production, off-farm labor, a domestic package and a mule package. As these four activity groupings are fairly complex, they are discussed separately in the following sections.

8.1.1 Off-farm labor allocation

Off-farm labor is the only activity category that has not been aggregated. This category consists of two separate activities, off-farm labor in the industrial sector, and off-farm labor in the informal sector as a laborer. 40 hours of youth labor a week in the industrial sector produce $9,000 pesos annually, of which 80% is contributed to household income in the form of remittances. It is assumed that the individual keeps twenty percent of the income for personal goods such as soda pops and occasional clothing articles. Bus fares are also provided from this individual portion.

Adult male labor can also be allocated to off-farm labor in the non-industrial sector as a laborer. However, this allocation is limited to 20 hours per week per adult male due to the relatively small market for these services within the area. In addition, this work is paid only $30 pesos for ten hours of work, slightly below the minimum wage. This adjustment is made because many of these positions are in the informal sector, or are a conglomeration of many small jobs that are paid individually, negating the minimum wage regulations. Other options for male labor would include rural-urban migration that is not included in this model due to difficulties in evaluating the true cost-benefit of this activity.

Figure VI: Flow chart for household labor allocation alternatives: Encircled units are those groupings specifically included in the LP model, while square units provide additional levels of aggregation or dissaggregation to clarify activities and actual products. Units in red are model inputs, while green units are model activities.



8.1.2 Domestic package:

The domestic package is the model activity that has undergone the highest degree of aggregation. It is also unique in that the consumption requirements, which can be met by household production, or from off-farm sources at a slightly higher price, are included as specific restrictions in the activity column of the domestic package. This constraint is of a unique nature. Consumption requirements are met as part of the aggregate domestic activity, which is constrained to one unit. As opposed to most constraints which typically apply to inputs, constraining this activity results in the satisfaction of many household requirements which would have otherwise been ignored by the model due to the inability to apply a monetary value to their performance. Due to this lack of monetary value, the profit-maximizing model would otherwise have no incentive to apply any of the scarce household resources to this activity.

The domestic activity package includes food processing, small livestock, patio agriculture, childcare, meeting family nutritional requirements, and household maintenance. Based on interviews and observations, one unit of the domestic package is assumed to require a minimum of 6 female labor hours daily. Other inputs, such as a minimum amount of corn, beans, meat, vegetables, and capital are combined with the labor hours to result in a variety of products, some of which are quantifiable with a money value, and some of which are solely necessary for the survival of the household. The following figure evaluates the domestic package, its activities, inputs and outputs (Figure VII).

As this figure demonstrates, the combined inputs in the domestic package give rise to a specific set of outputs, as several of these outputs help fulfill the initial input

conditions, an output-input transfer is created. Table VIII lists the quantifiable inputs and outputs, and the resulting net input requirement which is accordingly included as the net requirement for the one unit of domestic activity as required by the model.

Table VIII: Quantifiable inputs and outputs for domestic activity, and net input requirements for one annual unit of activity.

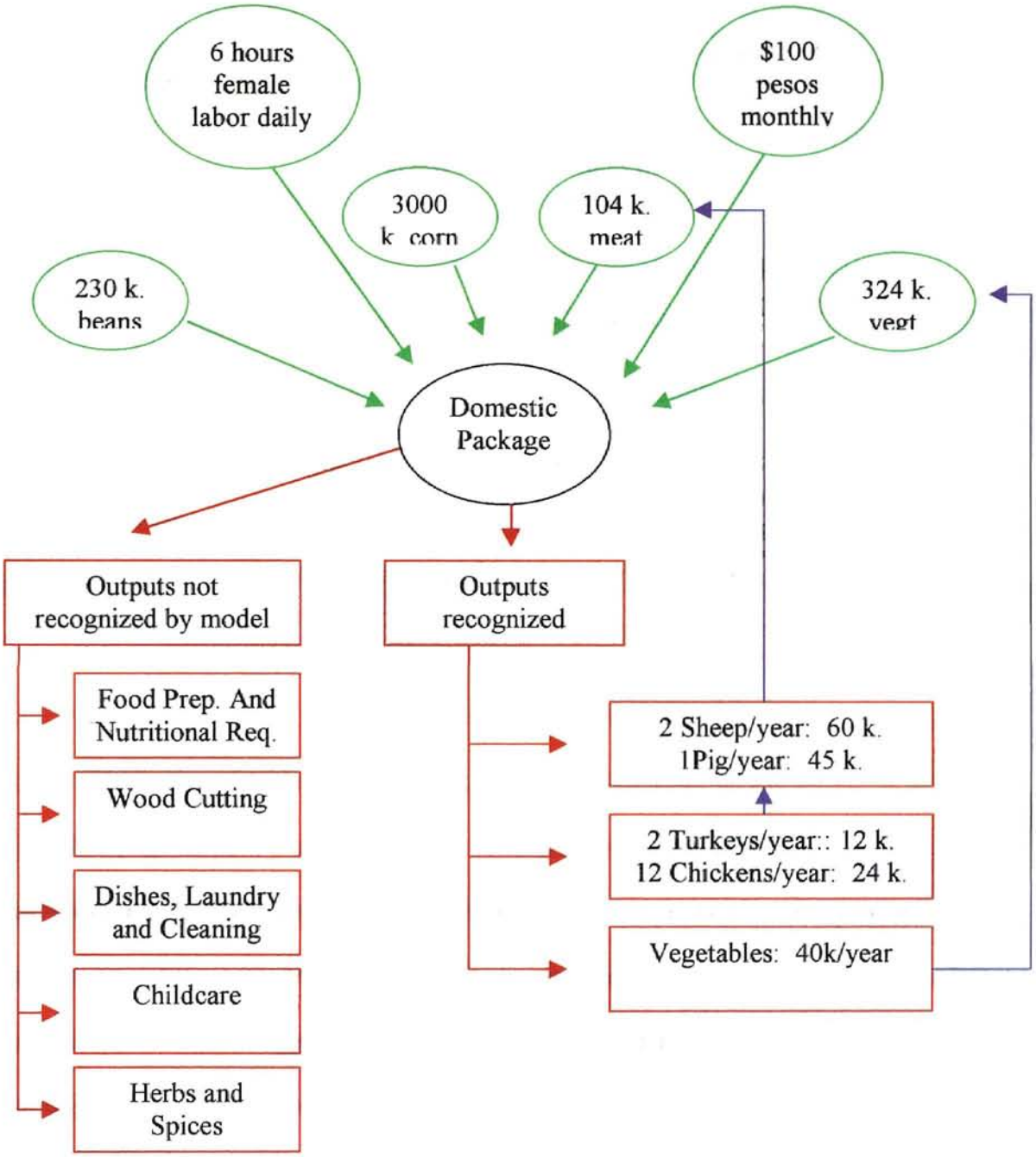
Resources	Inputs	Outputs	Net Input
Labor	1500	0	1500
Capital	1200	0	1200
Corn	3000	0	3000
Beans	230	0	230
Vegetables	324	40	284
Meats	104	141	-37

This table indicates that the one unit of domestic activity, as required by the model will adsorb x units of labor, capital corn, beans and vegetables, acting as a constraint on these resources. As the activity is a net producer of meat, this excess will be available for sale.

8.1.3 Mule Package:

The mule package is similar to the domestic package in that it acts as a restraint despite its inclusion as an activity. This activity is restrained to one unit, and includes all the requirements and outputs associated with the upkeep of one large work animal for one year. The following chart (Figure VIII) specifies these associated inputs and outputs. This activity was included as a restriction to avoid the implementation of a fraction

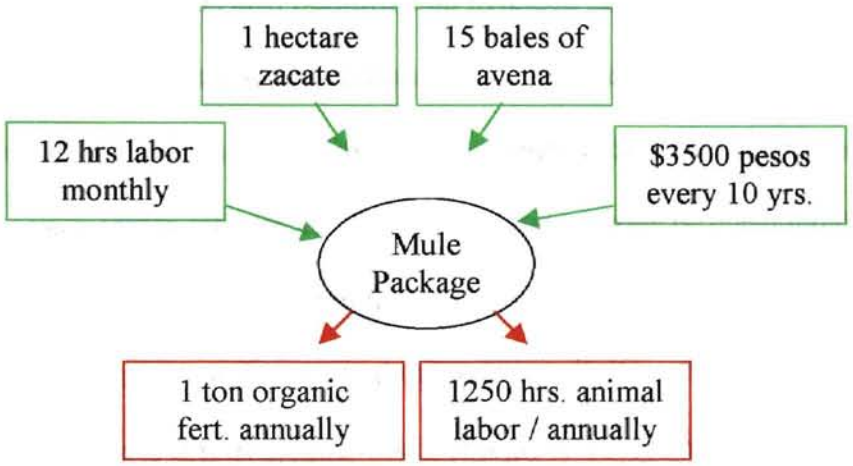
Figure VII: Input, output, and activity definition for one annual unit of the domestic package, as required by the model.



Note: Input transfers to the domestic package are in green, domestic package output fabrication is in red, and output -- input transfers are indicated in blue.

of a mule by the model, an alternative which was viewed as unrealistic based on field observations.

Figure VIII: Input, output, and activity definition for one unit of the mule package, as required by the model.



Note: Input transfers to the mule package are in green, and mule package output is in red.

8.1.4 Agricultural Activities:

The agricultural category includes several activities in the model. As these activities are only slightly aggregated in the model, it is necessary to clarify them. These agricultural outputs include crops at various levels of aggregation. Maiz chico, grande, blanco, and azul are all aggregated under corn, as the principal difference is time of planting and harvest, and labor requirements are relatively the same across all three varieties. Beans, which include frijol and haba, are aggregated. Small grains were also aggregated into one category due to similarities in production methods, yields and prices.

This category includes oats, wheat, and barley. Potatoes are an independent activity due to their unique production and processing characteristics.

Corn, beans, potatoes and small grains are all represented by two distinct activities, production on rain fed lands and production on irrigated lands. Production of lettuce, betabel, and carrots was also permitted on irrigated lands, and is represented by two distinct activities – first season production and second season production. The irrigated nature allows the production of two crops annually for these vegetables. However, prices vary across seasons, requiring that these seasons be considered different production activities. Other crops planted in the area were excluded as their extremely small quantities of production were assumed to have a negligible effect on overall production strategy. Due to different labor requirements were associated with the usage of organic and inorganic fertilizers, all crop groups are represented by production with both organic fertilizers as well as inorganic methods.

The end result is four distinct production activities for each of the seven crops evaluated in the model. Temporal crops can be produced either on rainfed lands or irrigated lands, and have the option of two fertilization methods on both land types. The vegetable crops which are limited to irrigated lands can be produced either in the first or second production seasons, and also have the option of two fertilization methods on both land types. This results in a total of 28 crop activities. While there was also a need to distinguish between crop production with animal and/or machine power, this would have doubled the number of crop activities to 56, an amount that was viewed as unmanageable. Alternatively, this situation was dealt with by way of a barbecho transfer row that allowed each activity to transfer in the required amount of land preparation activities

from a variety of sources, as the model saw fit. This allowed one single crop activity to choose from land preparation by animal or machine power based on overall changes in returns and efficiency.

8.2 Inputs

Inputs include land, labor, and capital although capital is tracked in the objective function rather than as a resource row. The characteristics and constraints of these household resources are discussed in the following sections.

8.2.1 Land

Land is constrained to 4 hectares, which is the average plot size among survey participants in the area under study, and is not differentiated by quality. As the principal difference between plots in the study area is rainfall and irrigation, land is separated into irrigated and temporal. As producers in general have access to either irrigated or temporal lands, but not both, the model is estimated with all available household land in one category, and then re-estimated with a land resource base in the second category. This allows for a realistic evaluation of the different production strategies adopted by households with the varying resource bases. To account for rainfall variations, two versions of the temporal lands model are estimated which take into account the different yields. The first estimation assumes yields associated with good-normal rainfall, while the second estimation is based on yields associated with little-late rainfall patterns.

8.2.2 Labor

Labor, which is gender and age differentiated, is limited to 40 hours per week per adult member. Labor is not adjusted for the impacts of weather or illness on availability, and is separated by month. As derived from survey data, household labor composition consists of two adult males, one adult female, and one female youth. A youth is considered between the ages of 18 and 27, and while one unit of youth labor is assumed equivalent to one unit of adult labor, it must be distinguished due to distinctive hiring patterns in the industrial corridor. Age discriminate hiring practices effectively restrict the labor which can be allocated to off-farm industrial labor to that in the youth age group.

8.2.3 Capital

Capital is not explicitly constrained, however there does exist a lack of access to credit among rural producers. While government lending programs exist for the rural sector these services are not actually available to the peasant producer due to extensive bureaucracy and suspected corruption. Private lending is similarly inaccessible to many subsistence producers beyond the actual value of any chemical fertilizer used, as this credit is often extended by the fertilizer vendor. However, as the capital expenditure for production to not generally exceed this cost, there is no need to explicitly restrict credit. This variable is implicitly restricted, as the model does not allow for land or labor purchases, keeping expenditures and production within the existing household limits. Capital must be utilized not only for production costs, but also for household expenditures. Household expenditures are predetermined based on interview data, while

production costs involve fertilizer purchases, and fumigation. Seed is assumed to be saved from the previous years harvest, and is an implicit constraint (with the exception of lettuce, carrots, and betabel).

8.3 Transfers

Both purchase and selling activities are included for all commodities produced and consumed by the household (with the exception of vegetables, which are produced in such small quantities that no efficient marketing channels exist for their sale). The subsistence nature of the agricultural system is incorporated as a price difference between commodities sold and commodities purchased. This encourages the household consumption requirements to be met by household on-farm production rather than off-farm purchases. While other approaches have included constraints which force the household consumption to be met by on-farm production (Epplin and Musah, 1987), it was felt that a direct constraint would be too strong for this model, as consumption requirements often must be met from off-farm sources when production is not sufficient to met annual requirements.

Labor transfer columns are provided for every month which allow the following activities: 1) the transfer of female labor to non-gender specific tasks, 2) the transfer of male labor to non-gender specific tasks, and 3) the transfer of limited female labor to youth specific tasks (as one unit of female youth labor is equivalent to one unit of adult female labor, these were grouped under female labor in the initial resource allocation, and are only separated by the model if youth labor is specifically needed).

8.4 Graphic Depiction

The completed model, as depicted in Appendix V, includes 72 rows and 92 columns. Of these 92 columns, 28 represent agricultural activities, 2 are used for the two package activity constraints, 2 represent off-farm labor allocation activities, and 5 represent various production method activities (fumigations, and varied land preparation and fertilization methods). An additional 19 columns provide for all commodity purchase and sales activities, while 36 labor transfer activities allow for a monthly redistribution of labor by age and gender. The data for the model is derived directly from the enterprise budget, which lists and groups the various labor activities by month and gender. The model allocates gender differentiated labor supplies to gender neutral activities by way of the labor transfer activity column, which also permits the transfer of female labor to the off-farm industrial sector. Due to the size of the model, it is not here presented in its complete form, however, the attached disk does hold the original model in its entirety for revision.

8.5 Production Systems

This model was evaluated under distinct categories of production systems. That varied based on their natural resource endowments. The response of producers with various resource endowments to the changes in policy variables was estimated in four separate variations of the previously described model. This was reflected by changing yields and land allotments (size and type) to accurately reflect the type of endowments present in each of the communities present in this study. The following table evaluates the communities under study with respect to these groupings.

Table IX: Production systems classified by resource endowment.

Grouping	*Crops*	*Representative Communities*
1) Irrigated	Vegetables, Grains, Beans	Cárdenas
2) Moist Temporal	Grains, Beans, Potatoe	Zapata
3) Dry Temporal (large land endowment)	Grains, Beans	Zotoluca
4) Dry Temporal (small land endowment)	Grains, Beans	Capula, Santa Fé

The principal groupings of production systems were evaluated as follows: 1) irrigated producers; 2) rainfed producers with moist soils; and 3) rainfed producers with arid soils. This last category was separated into large and small producers, as the size of the land allotment was expected to make a large difference in their decision making process. Producers in this category exhibited widely varying parcel sizes, unlike producers in other groupings.

9. RESULTS

As the household model was evaluated in several stages, including a general survey and visual evaluation, a linear programming model, and a sequence of in-depth interviews, the results for these distinct activities must be evaluated individually. In order to evaluate the impact of NAFTA on these rural communities it was necessary to first determine how the free trade agreement has affected commodity prices and industrial demand for labor. This data was analyzed by way of industrial interviews, and a simple data evaluation. These results are presented below, followed by an analysis of the linear programming model results. The social evaluation that concluded this study was based principally on interview data, and is presented following the linear programming results.

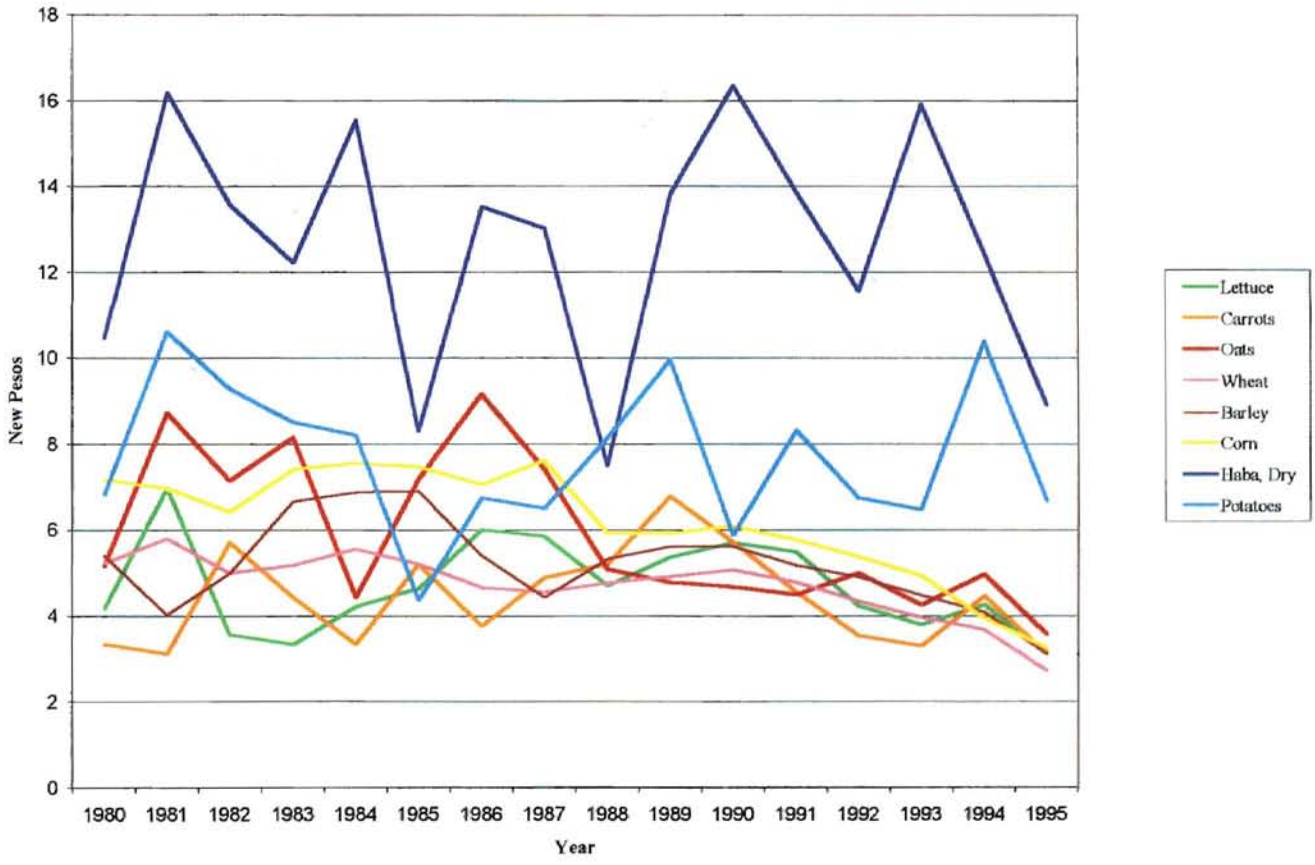
9.1 Changes in Commodity Prices

Changes in commodity prices were not formally evaluated, as such a process would have involved the construction of a theoretically appropriate demand system (a price dependent commodity system with policy changes included as independent variable was seen as most appropriate). The data and time requirements for such an approach, however, were seen as too extensive for a study of this scope. Alternatively, producer interviews, literature reviews, and interviews with appropriate government agencies substituted for this process, providing an evaluation of price changes over the past 10 years, and a rough estimate of approximately what portion of these changes is reasonably attributable to policy changes. This estimation occurred through a process of graphical analysis of available price and trade data. While it is recognized that an approach of this

type is highly questionable, it did provide a reasonable 'guesstimate' as to probable price impacts of NAFTA for use in the linear programming analysis.

Price data was collected for a fifteen year period from 1980 to 1995 for each of the commodities produced in the agricultural communities in the Xicohtencatl area (with the exception of betabel, or turnip, for which price data was not available). This data is presented below in Figure IX.

Figure IX: Mexican producer prices for commodities produced in the Xicohtencatl agricultural areas, 1980-1995. Source: Food and Agricultural Organization of the U.N., 1999.



Production quantities for each of the commodities under evaluation was also obtained for the same time period to address price fluctuations related to supply

variations. This data is presented below in two distinct figures (Figures X-A and X-B) due to variations in scale.

This production data indicates that production for wheat, potatoes, barley and haba has been fairly constant for the time period from 1990 to the present. When viewed

Figure X (A): Total agricultural production of Mexico for crops produced in the Xicohtencatl agricultural area, 1980-1998. Source: Food and Agricultural Organization of the U.N., 1999.

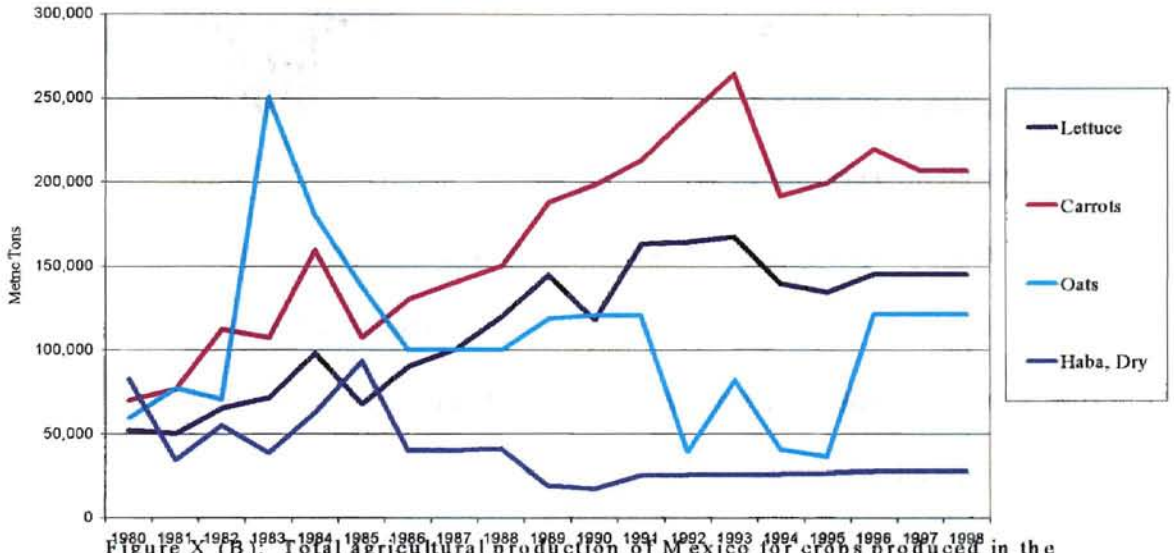
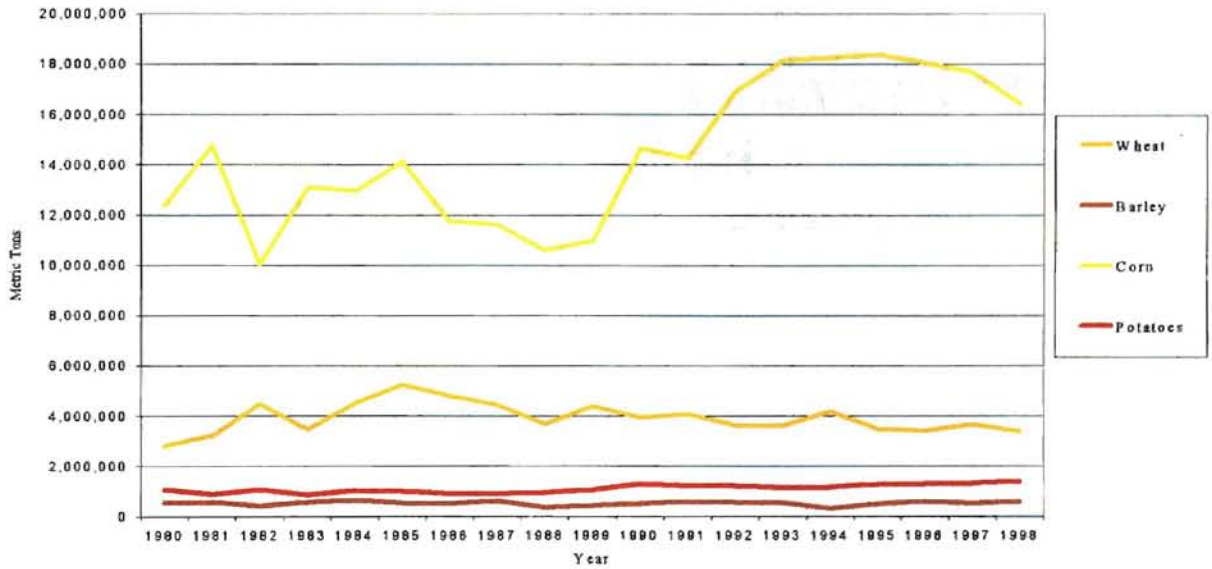
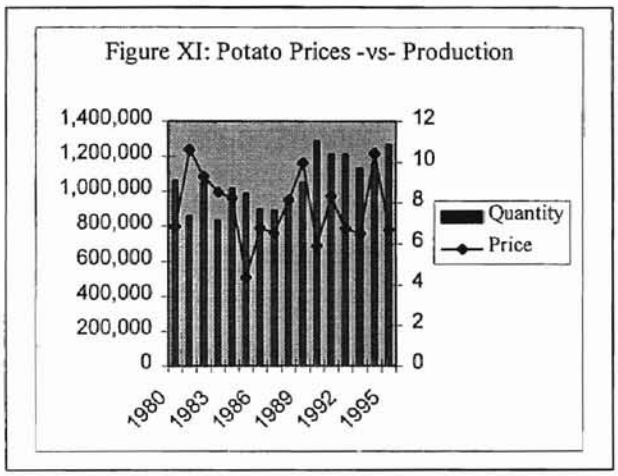


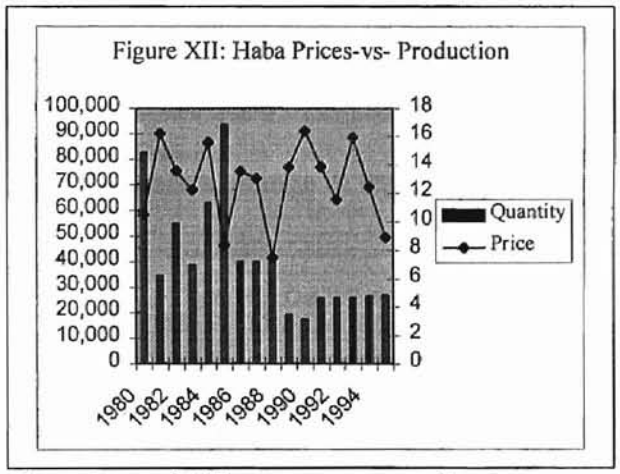
Figure X (B): Total agricultural production of Mexico for crops produced in the Xicohtencatl agricultural area, 1980-1998. Source: Food and Agricultural Organization of the U.N., 1999.



in conjunction with the price data presented in Figure IX it is obvious that the commodity prices for both wheat and barley have reflected this stability, however, this is not the case with haba and potatoes, whose prices in recent years present the highest degree of fluctuation among all commodities under evaluation. Given the relative stability of supply for these commodities over the same time period, it is assumed that external factors are exerting a strong degree of influence on these commodity prices. This factor is reinforced in Figures XI and XII, in which production data is graphed against price fluctuations.

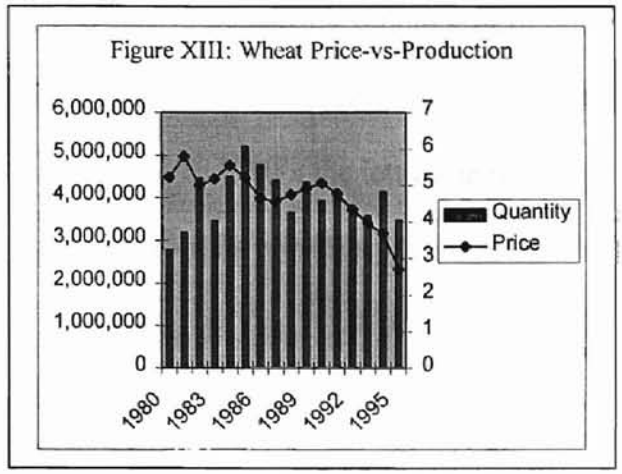


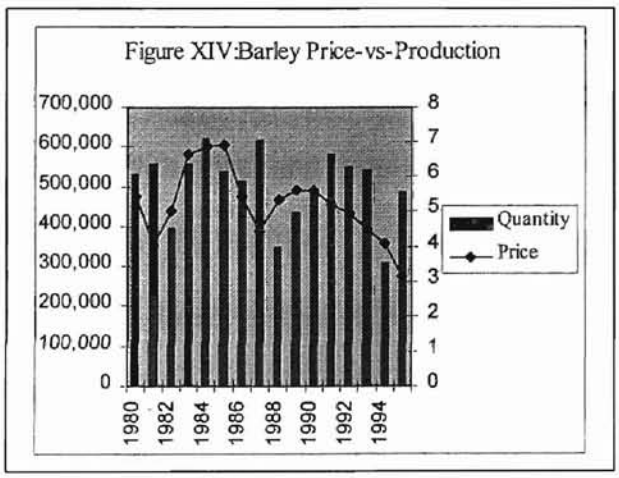
An additional feature visible in the previous price chart addresses price trends across crops. It is noticeable that all crops (with the exception of haba and potatoes) have been exhibiting strong downward trends since the late 1980's. In fact, of the entire time span from 1980-1995, there is only one year in which all 8 crops exhibit simultaneous price drops. This year, 1995, is closely accompanied by 1987 and 1992 in which the prices of all but one commodity lost significant value (carrots and oats respectively).



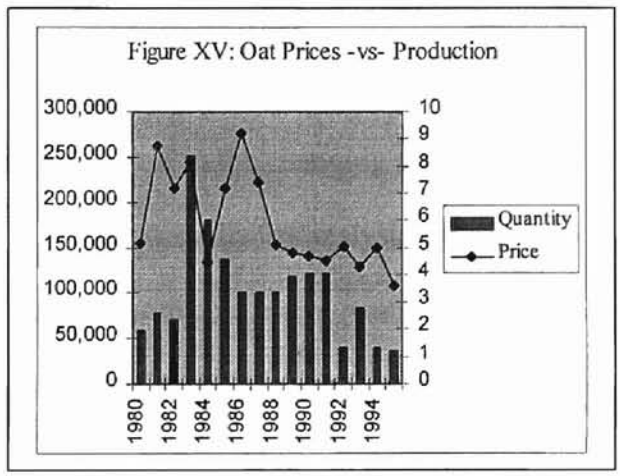
While this pattern does indicate a deep and continued loss in real prices for agricultural products in the past decade, the most interesting patterns become obvious

when the price data is viewed in conjunction with supply data across individual commodities. All three grains produced in the Xicohténcatl area (wheat, barley, and oats) exhibit simultaneous drops in both price and production over the last five years (1990-1995) as demonstrated in Figures XIII-XV. It has been hypothesized by other sources that Mexican small grain production under NAFTA would likely be replaced by U.S. imports due to its relatively land and capital intensive production methods (see chapter 5 for details).

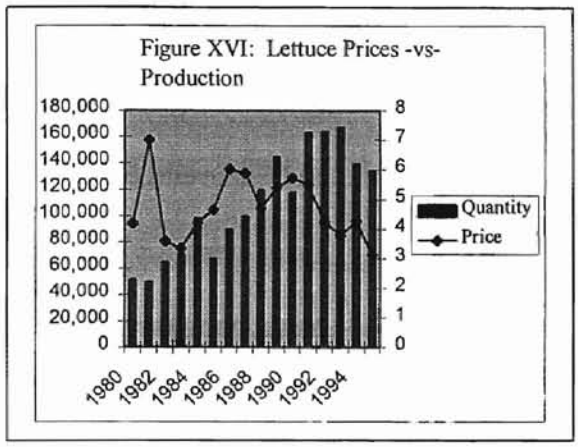




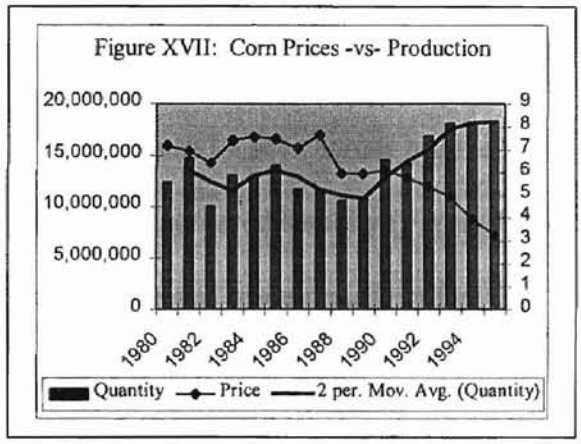
Other crops demonstrate patterns that are quite distinct, yet strikingly similar in their inception dates. The early 1990's mark a change in trend across all crops, and this new developing pattern generally includes a loss in value. This pattern is present in the lettuce market, however, the cause is uncertain as the recent fall in prices was also accompanied by a three year span of increasing production (Figure XVI). Therefore, it is uncertain if



this fall in price is a result of NAFTA induced changes, of increasing supplies, or of other market factors. It is clear, however, that in the early 1990's the lettuce market broke from its previous pattern in which prices moved fairly independently of production.



Corn has also followed a similar pattern in recent years. From 1980 through 1989 corn prices tended to move with supply, raising when production increased and falling when production was low, rather than against it as expected by economic theory. This trend changed abruptly in the early 1990's, with prices and supply diverging sharply for the first time. Once again, this long term downward trend in price (6 years) was accompanied by steady increases in production, making it difficult to hypothesize about the causes of this loss in value.



While these patterns and trend changes which have been seen in all crops in the 1990's hint that the NAFTA is very likely playing a role in the changing price structures, specific conclusions cannot be reached on this basis. A statistical analysis would be needed to tie NAFTA to these shifting patterns in a more conclusive manner, however, due to the extremely short time period over which the NAFTA agreement has been in effect, data limitations hinder most attempts to measure this effect. In general, most

economic studies and evaluation have concluded that the NAFTA agreement is expected to increase Mexican imports of corn and small grains, and augment their exports of fruits and vegetables, with appropriate associations in price changes. This trend appears to be supported with the preliminary trade data, which shows a strong increase in basic grains import in recent years (Figures XVIII, XIX, and XX).

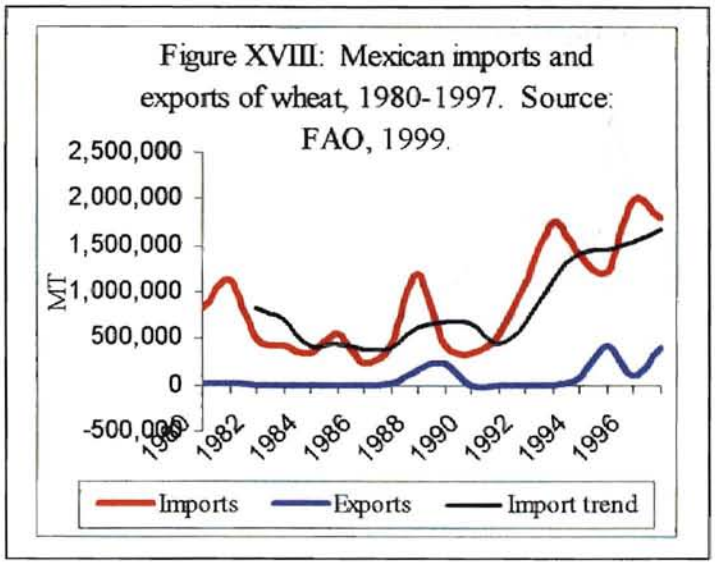


Figure XVIII: Mexican imports and exports of wheat, 1980-1997. Source: FAO, 1999.

Exports of the vegetables included in this study have also followed predictions, with steady increases visible in recent years. This trend can be seen across both lettuce and carrots to varying degrees. In lettuce, exports have increased steadily (Figure XXI). However, Mexican imports of lettuce have actually increased more rapidly, a fact that should combine to result in downward pressures on lettuce prices.

Carrots have also experienced increases in imports in recent years, but in this case the import increase has been minimal in relation to the export growth (Figure XXII). This rapid market expansion for carrot production implied by the expanding export sector is expected to provide upward pressures on carrot prices. While this hypothesis is not supported by the graphical analysis of carrot prices, which have demonstrated downward trends over the same time period as increasing exports, it may be that carrot prices are currently responding to other stronger market forces.

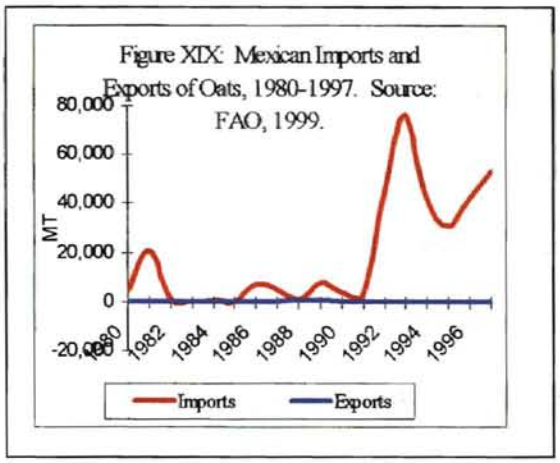


Figure XIX: Mexican Imports and Exports of Oats, 1980-1997. Source: FAO, 1999.

Figure XX: Mexican Imports and Exports of barley, 1980-1997. Source: FAO, 1999.

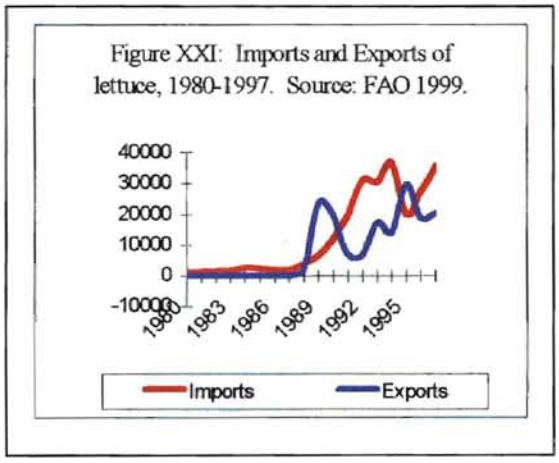


Figure XXI: Imports and Exports of lettuce, 1980-1997. Source: FAO 1999.

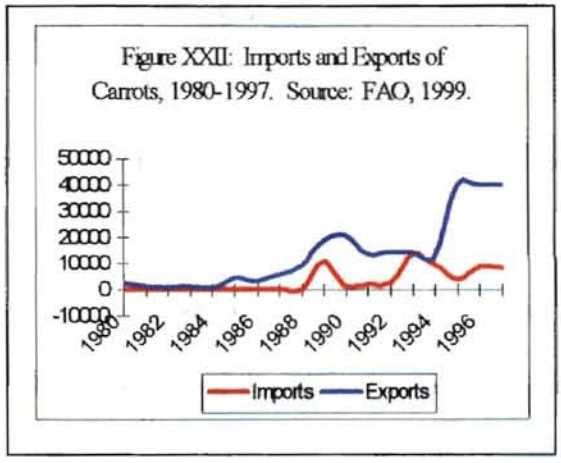


Figure XXII: Imports and Exports of Carrots, 1980-1997. Source: FAO, 1999.

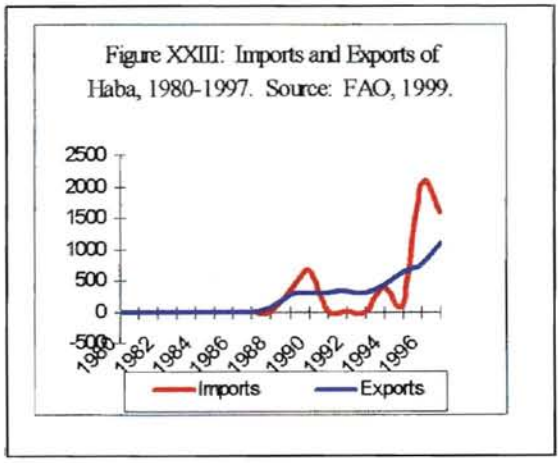


Figure XXIII: Imports and Exports of Haba, 1980-1997. Source: FAO, 1999.

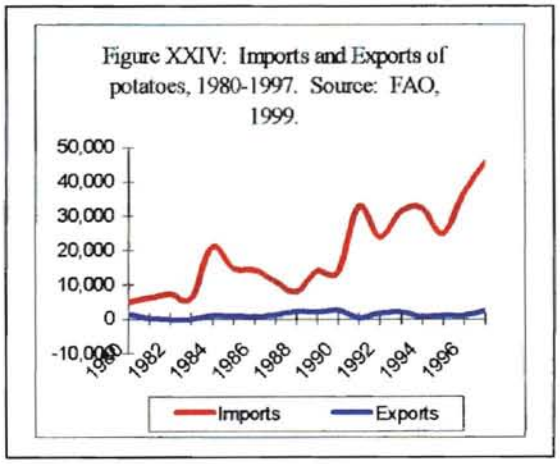


Figure XXIV: Imports and Exports of potatoes, 1980-1997. Source: FAO, 1999.

Haba and potatoes are two crops that demonstrated interesting trends in the previous graphical analysis, therefore giving them special interest in the import/export analysis. Haba appears to have gone through a similar trade pattern in recent years to lettuce, in which exports have increased significantly, only to be overshadowed by rapidly soaring imports (Figure XXIII). The drastic annual changes in net trade balance (in both sign and value), in recent years may have contributed to the recent price instability seen in the graphical analysis which had been unexplainable with production data alone.

While potato prices had appeared equally random in their price fluctuations (with respect to production data), the evaluation of trade data does not seem to spread any light upon the cause of these variations. Imports have steadily increased, while exports have remained minimal, a situation which is expected to provide downward pressures on price. This pressure, however, is not visible in the graphical analysis (see Figure IX, pg. 80). While prices have been highly variable from year to year, potato is one crop which has not shown the general downward price trend present in many of the agricultural commodities under study.

Based on the sum total of these evaluations, it is expected that NAFTA will contribute to the existing downward price trends for corn and small grains (wheat, oats, and barley), provide upward pressures on carrots, which like the downwards pressures for potatoes may not actually change the price, but simply offset other influencing factors. The effect on prices for lettuce and haba appears uncertain, and for the purposes of this study is to be left constant. As more accurate data is developed in the future, it may be

prudent to reevaluate the linear programming model with respect to the price effects of NAFTA to receive a more accurate evaluation.

9.2 Changes in Industrial Demand for Labor

Changes in industrial demand for labor was conducted in a similarly informal manner. Interviews with the industrial sector and appropriate governmental agencies provided information with respect to the expansion of the industrial sector, growth in the job market in the industrial sector, and an estimate of approximately what quantity of this expansion is reasonably attributable to NAFTA.

The industrial corridor of Xicohténcatl has expanded greatly in the past 15 years, and much of this expansion (which has occurred in large part in recent years) has been attributed to NAFTA. As seen in the attached figure, the number of jobs available in the corridor has almost tripled since 1993, the last year before NAFTA was enacted (Figure XXV). In addition, the number of operating factories in the corridor has also nearly doubled in the four years of available data since NAFTA implementation. This recent growth almost equals the sum total of all growth which had previously occurred over the first 16 years of the corridor's 20 year life-span (Figure XXVI).

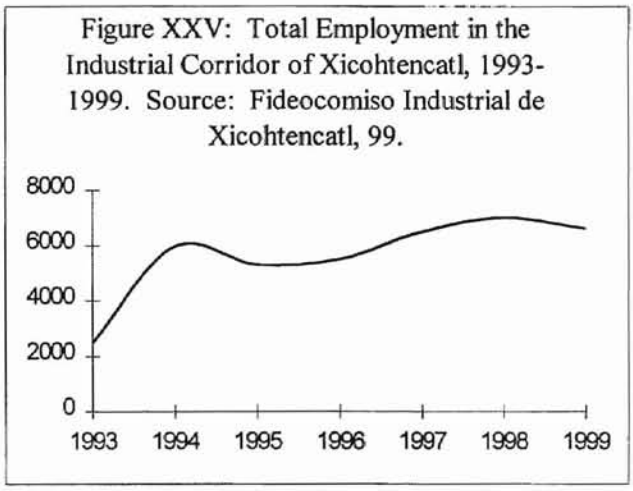


Figure XXV: Total Employment in the Industrial Corridor of Xicohtencatl, 1993-1999. Source: Fideocomiso Industrial de Xicohtencatl, 99.

While rapid increases in both the number of operating factories and quantity of employment available are visible upon the implementation of NAFTA, there are other contribution to the industrial sector which are not quite as obvious. The Fideicomiso indicates that firms with foreign backing have preformed better through periods of domestic economic crisis due to the national firms limited access to capital and to foreign markets. Therefore, as post NAFTA expansion has included a large number of firms operating with foreign capital, it is expected that this will lend more stability to the employment offered in the corridor, and help adjust for problems domestic firms may be facing.

In addition to data over industrial expansion and increased demand for labor, the interviews revealed an interesting trend in local labor markets which was highly relevant. While interviews conducted with industrial representatives and officials in the Ciudad Industrial de Xicohténcatl revealed several social characteristics about industrial employees, the most interesting by far was that of gender composition. An interview with the personnel manager with Linda Vista (appendix II), a clothing factory, revealed that the majority of employees are young females, with an average age of 22-24. This and other employee characteristics are presented in Table X.

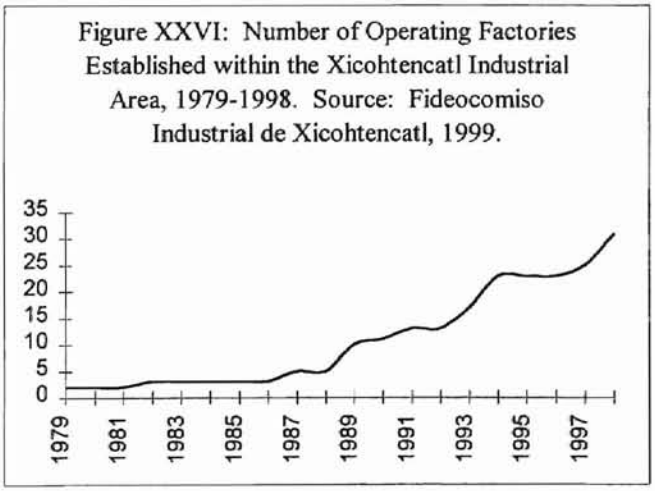


Figure XXVI: Number of Operating Factories Established within the Xicohtencatl Industrial Area, 1979-1998. Source: Fideocomiso Industrial de Xicohtencatl, 1999.

Table X: Summary of employee characteristics in the Fabrica Linda Vista, Industrial Corridor Xicohténcatl, July 1998.

	Total #:	Percentage Female	Percentage Male
Factory Employees	2600	57%	43%
Laborers	2000	70%	30%
Engineers	36	25%	75%

Civil Status:		Average Age:	22 - 24
single	71%		
married	24%	Average Salary:	35.75 daily
single mothers	6%		

Origin:	
Apizaco	23%
Xalostoc	18%
Tetla	13%
Huamantla	9%
Other	36%

This factory is not unique in its heavy employment of female labor. Ing. Alma Inés Zamora, with the Fideicomiso Industrial of Xicohténcatl, indicated that many industries express a preference for female labor due to their more accurate attention to detail, promptness in arrival, and willingness to work overtime. While only 46% of the corridor's total employees are female, in four out of five of the corridor's largest employers, women provide the majority of labor requirements. These factories are the only large-scale firms in the corridor, with no other individual firm employing more than 250 employees. As a group these firms employ 5113 workers, or 77% of the corridor's total labor force, and their hiring patterns with respect to gender strongly affect the job prospects available for the off farm allocation of labor for rural families.

This gender trend was not limited to the industrial corridor. Emiliano Zapata has a large number of sewing tallers which also offer employment principally to young women. While these local workshops are quite successful in Zapata, none of the other surrounding communities have implemented them. A community official in the town of Capula, indicated that they had attempted at one time to open a workshop for local women but it had not been successfully (Appendix III). When asked why the village did not have a workshop, the presidente responded, "Pues supuestamente, la casa existe. Pero aquí nadie . . . nadie hizo." A possible explanation is that the taller in Capula was geared towards women who were to old to go work in the corridor, while the Zapata talleres utilize youth labor. It is important to note that many of the positions available in the industrial corridor are limited to literate applicants. This excludes a large number of households from participating in this sector.

9.3 Linear Programming Model Results

The linear programming model was used to evaluate household response patterns to changing industrial demand for labor and shifts in commodity prices. Due to labor surpluses in the region, changes in industrial demand for labor have not effected any real changes in wage levels, and the wage has been maintained at the legal minimum despite extensive growth in the industrial sector and its associated labor requirements. As these changes in labor demand cannot be accurately evaluated using any changes in industrial wages, the model evaluated each situation in two distinct manners:

1) With the option of regional industrial labor allocation by household youths, and

2) Without the option of regional industrial labor allocation

As the industrial sector expands and its labor demand increases, it is assumed that more households will have option (1), allowing for an estimation of this change at the level of the individual household. In addition, the models were estimated at various price levels to include the estimated price effects of NAFTA, at various yield levels to account for various natural resource endowments, and with distinct land resources with respect to irrigation. The variation of these economic and endowment factors allows an evaluation of how both policy and resource factors affect the viability of the rural household, and how production strategy is altered under a variety of different circumstances.

Table XI: Price schemes evaluated in model.

Crop	**Evaluated Range of Price Effect**		
Corn	-15%	-35%	-50%
Small Grains	-15%	-35%	-50%
Potato	-5%	-10%	-15%
Beans	10%	0	-10%
Lettuce	10%	0	-10%
Carrot	0	5%	10%
Turnip	---	---	---

The models were evaluated under various price schemes as the exact price effects were unknown, and a probable directional shift in prices was the only known information on NAFTA effects. These price shifts were evaluated at various levels as the true magnitude of these shifts is currently unknown. Table XI lists the various price change possibilities that were analyzed within the models. These results, combined with the changes evaluated with respect to the availability of off-farm labor alternatives are presented in the following sections, which are divided with respect to resource allocation.

9.3.1 Change impacts on Irrigated Lands

Irrigated lands were evaluated with a household composition of two adult males, one adult female, and one adult youth. Family resources consisted of 3 hectares of irrigated land, with no temporal land endowments. Before any changes were evaluated, the current price structure system was evaluated, with the specific price and production data collected from interviews. This resulted in one hectare allocated to the production of corn, with the additional two hectares dedicated solely to the production of lettuce in both the first and second growing seasons. This land distribution appears fairly accurate with respect to actual production techniques on the areas irrigated land as lettuce is the principal crop, however, its estimated corn production may be slightly higher than actual producer choices. An average of 10 male hours weekly were dedicated to off-farm labor, while female youth labor was found to be better applied in domestic and agricultural uses than in extensive off-farm application (only .13 of the total available full-time off-farm employment was utilized). Labor utilization by gender varied monthly, and is evaluated in Figure XXVII. This figure shows that the woman's workload is much higher in the early months of the year, while the man's workload peaks in the final period. In general, the woman's workload averages consistently higher than that of the male, a factor that is

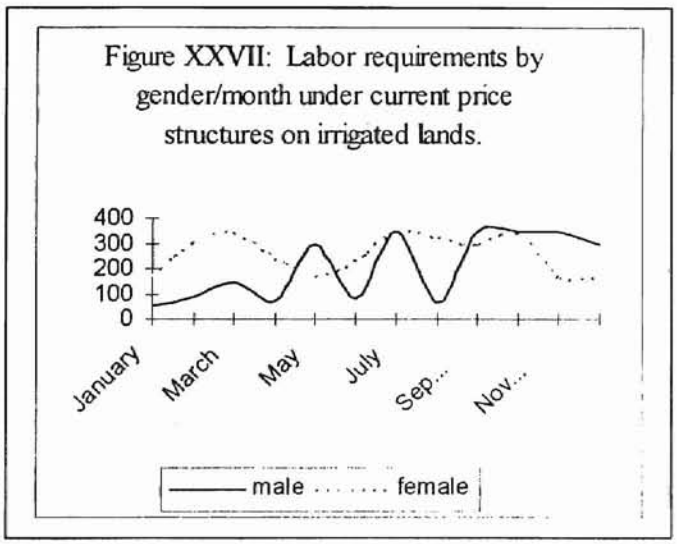


Figure XXVII: Labor requirements by gender/month under current price structures on irrigated lands.

likely attributable to the consistent nature of domestic labor requirements, which are met entirely by female labor.

Total return under the current system equals 136,866 pesos, from which any land or domestic improvements must be made, in addition to all family operating, educational, and medical expenses. In addition, the model consistently chose more labor intensive production techniques such as organic fertilizer applications and land preparation using animal labor. As these methods are generally rejected by many of the producers on irrigated lands, it is expected that the model will over estimate both actual returns and labor requirements as the alternatives currently in use require higher capital investment and less labor than the alternatives chosen by the model.

The first change made in this model was the removal of the off-farm labor allocation alternative for female youths. As NAFTA has had it's largest impact on industry in the large multinational factories that intensively utilize female labor, it is assumed that the free-trade agreement has greatly increased the number of families which have access to this option. Evaluating the model without this option will provide a realistic picture of the production options and alternatives that would have been available to a majority of families in this area without the implementation of NAFTA. The removal of this option resulted in an overall annual reduction in family income of only .2% to 136,517 pesos, with agricultural production remaining consistent at one hectare of corn, with all other land dedicated to lettuce. This reduction was particularly small due to the minimal allocation of female labor to the industrial sector in the irrigated resource sector. This indicates that for producers with access to irrigation, NAFTA's provision of

additional opportunities for industrial employment have been insignificant in affecting either their income levels or household production strategies.

To evaluated a full range of NAFTA impacts, the full model (including the NAFTA induced option for industrial labor allocation) was estimated under a range of probable price impacts. All reductions in the price of corn resulted in varying levels of increase in total family income. A 15% drop in the price of corn did not affect the crop distribution, and increased the original profit of 136,866 pesos to 137,016 pesos annually. A further decrease in the price of corn to 35% of its original value increased the family's annual gross margin by an additional 200 pesos, while a price decrease to 50% drove total family income up another 150 pesos annually. These increases in family income resulted from the fact that households with this resource base are net purchases in their corn requirements. As corn purchase prices are decreasing by an equivalent amount to corn sales price, these reductions caused a large savings in supplemental purchases. While expenditures were reduced, the reduction in sale price had no effect on final household income as all corn production was destined for household consumption.

The proposed reductions in small grains prices resulted in similar reductions in household expenditures without affecting production strategy. For these products, each 15% decline in prices was associated with approximately 50 pesos annual increase in net family income. All evaluated changes in potato prices resulted in no changes in either family production strategy or income levels, as was the case also with carrot prices. As the directional shift of NAFTA's price impact on beans was uncertain, the model was evaluated with both a 10% increase and 10% decrease in these prices. Neither shift changed the family production strategy, however, the associated changes in family

expenditures resulted in respective reductions and increases of approximately 270 pesos annually. Changes in the price of lettuce resulted in the most dramatic changes in family income, although even these changes did not result in alterations in the families original production strategy. Once again, as the directional impact on price was uncertain, the model was evaluated under both a 10% increase and decrease in lettuce prices. Family income resulted highly sensitive to these changes, with respective gains or losses of approximately 15,900 pesos annually dependant on the direction of the price shift.

Apart from any possible NAFTA induced changes in the price of lettuce, the rural household with irrigated land resources proved quite resistant to most price changes, and benefited from the majority of these shifts. Even the NAFTA induced availability of off-farm industrial was minimal in its influence. While minimal, this was the only NAFTA impact which actually changed the families production strategy (by applying $1/10^{th}$ of one female's available workload to this activity). While this did result in an increase in female workload of approximately 144 additional hours annually, this increase is seen as fairly negligible. It is hypothesized that these minimal price and industrial effects are a result of the quality resource base with which these families are working, and it is expected that the estimations for households with lesser resource bases will reflect a greater variation with respect to these changes.

9.3.2 Change impacts on Temporal Lands with high Rainfall

The NAFTA induced change impacts on temporal lands with higher rainfall and soil moisture (such as those located in the mountainous area surrounding Emiliano Zapata) were evaluated in the same manner as those for irrigated land, except that

resource availability and yields were altered within the model. Each family still utilized the labor resources of two adult males, one adult and one youth female. However, plot size was changed from 3 hectares of irrigated land to 4 hectares of temporal land (the average size of plots in the Zapata area).

This model was also estimated without industrial availability of labor for female youths and in the absence of hypothesized NAFTA induced price shifts to evaluate the full range of changes potentially induced by the free-trade agreement. This pre-NAFTA estimation resulted in a gross family income of 8,172 with production allocated as follows among agricultural activities:

Production Strategy 1:

corn: 1 hectare

beans: 1.5 hectare

small grains: 1.5 hectares

In addition the family household heavily relied upon the off-farm labor alternatives available to mature males as abañiles and laborers for supplemental income. The inclusion of industrial off-farm labor for female youths resulted in a small allocation of female labor to the industrial sector. However, this allocation was limited to .13 of the total available hours for one full time employee. This small allocation is likely a result of the already heavy nature of the female workload, which becomes a limiting constraint in this estimation. The inclusion of this option in the model resulted in an increase in total family income from 8172 pesos annually to 9304.

In addition to NAFTA induced labor changes, commodity prices were also evaluated. As the household originally allocated 1.5 hectares to the production of small grains for market sale, a reduction in small grain prices resulted in a detrimental effect in the family's overall income. An initial reduction of 15% resulted in a decrease from 9304 to 8625, or a 7% decrease in family income. A 35% price decrease resulted in further income reductions to 8513. However, and more importantly, they also resulted in a significant change in the families production strategy. With a 35% price reduction in small grains prices, all small grain production on moist temporal lands was ceased, and production was reallocated as follows:

Production Strategy 2:

corn: remained equal at 1 hectare

beans: increased from 1.5 hectares to 1.8

potato: increased from a 0 hectare allocation to 1.2 hectares

small grains: reduced from 1.5 hectares to 0

off-farm male labor allocation: reduced from 2.8 to 2.57.

This change in production structure away from small grains has been predicted in much of the literature with respect to NAFTA induced changes in production structures. Beyond this point, however, increasing the price fall of small grains from 35% to 50% did not continue altering the production structure. Rather, it began improving family income slightly as the household unit was now functioning as a net consumer, rather than

producer, of this commodity. This additional price drop resulted in a small increase of family income from 8513 to 8558.

Once again, the household unit was a net purchaser of corn, resulting in overall improvements in the household return with the NAFTA associated fall in corn prices. As these households are also producers of this commodities, this occurrence supports the hypothesis that among subsistence producers, commodity price drops will not have a significant negative impact upon the viability of the production system. Indeed, in this case it has made this production system more profitable due to increased savings from the purchases of supplementary commodities. As the price of corn was decreased by 15%, 35%, and 50%, family income increased from 8558 pesos to 9008, 9608, and 10058 pesos respectively, while production remained unchanged.

While most changes in potato prices left production similarly unaltered, these price drops were not as forgiving with family income. As the household is principally a producer of this commodity for the formal market (versus a subsistence producer or consumer), price drops in this commodity resulted in significant drops in family income. The model was evaluated with drops of 5, 10 and 15 percent. These losses in value resulted in decreases in family income from 1008 pesos annually to 9841, 9625, and 9419 pesos respectively. In addition, the final decrease of 15% resulted in significant production shifts, as all available acreage was diverted to beans production.

The model also showed to be quite sensitive to changes in bean prices. While the probable directional shift of any NAFTA induced price changes in beans was uncertain (if any such effect indeed exists), the model was evaluated with both small increases and decreases to better understand the potential impacts of such a change. A small price

decline of 10% did not change overall production strategy (which was equal to the earlier defined production strategy 2), but did result in a drop of family income from 9419 pesos annually to 8944 pesos. A 10% increase in bean prices was not only enough to raise family income from 9419 pesos annually to 10230 pesos, but also to cause the families acreage to be allocated entirely to bean production. In addition, this price increase was sufficient to prompt a change from the usage of organic fertilizer (as has been previously applied on all crops under all other production systems) to a more capital intensive inorganic usage.

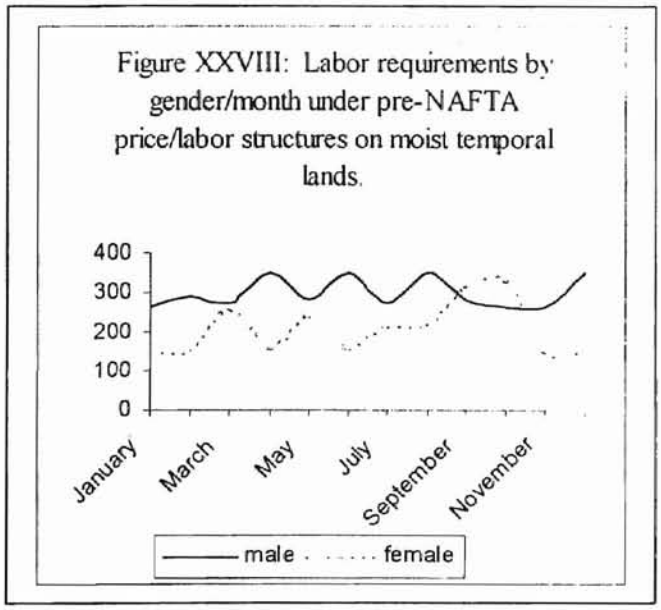


Figure XXVIII: Labor requirements by gender/month under pre-NAFTA price/labor structures on moist temporal lands.

In addition to altering family income and production systems, this combination of price changes and availability of industrial labor has the potential to deeply effect the workload distribution across gender. The following figures examine the labor requirements of the moist temporal lands by gender and month before and after NAFTA induced changes. It is important to note that the after model from which these labor requirements are drawn was based upon the maximum commodity price changes evaluated, and it is possible that the actual changes will not be as extensive. As can be seen in these charts, in the initial unchanged model male labor requirements average consistently higher than those of the female workload for the majority of the year (Figure XXVIII). As the NAFTA induced changes are taken into account in the second figure, the female workload is increased

drastically relative to that of the male (Figure XXIX). In addition to quantity of workload, quality must also be considered. In the pre-NAFTA model, the male members of the household were quite active in the off-farm sector, and this activity was reduced in the post-NAFTA model. Females, to the contrary, increased their participation in the off-farm sector in response to NAFTA changes. It is also interesting to note that this increased participation in the off-farm sector, while minimal, provided more than enough additional income to offset any negative price impacts of NAFTA on local commodities.

9.3.3 Change impacts on Temporal Lands with low Rainfall

The NAFTA induced change impact on temporal lands with low rainfall were evaluated in an identical manner to those on moist temporal and irrigated lands. While household composition remained the same, land allocation was a unique factor in this evaluation. Dry temporal lands were evaluated with two separate plot size allocations to evaluate the impacts of scale on the viability of the rural household. This was done due to the wide variation in the size of land parcels among dry temporal producers, which is expected to extensively effect both overall production strategy and response to NAFTA induced changes. These parcels were evaluated at both 3.75 hectares and at 5.75 hectares, the full range of

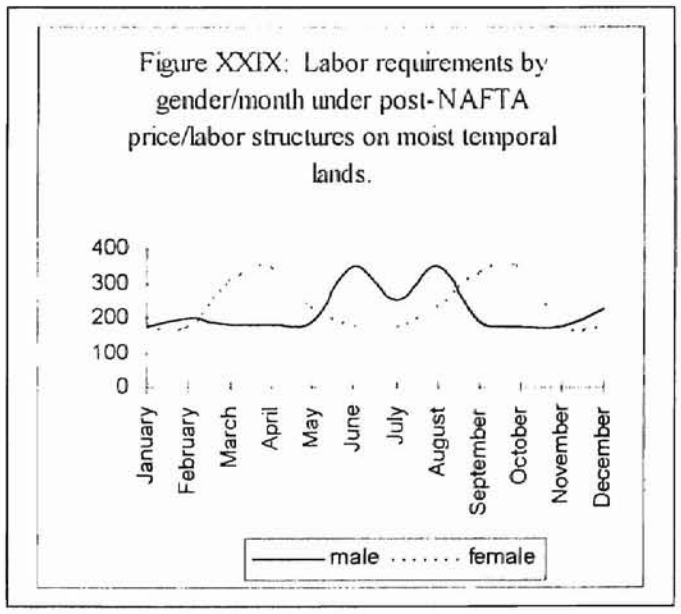


Figure XXIX: Labor requirements by gender/month under post-NAFTA price/labor structures on moist temporal lands.

variation across average plot sizes in the various villages functioning under the dry temporal model.

Again the model was initially evaluated without the option of industrial allocation of labor by household youths, and in the absence of any hypothesized NAFTA induced price changes. This estimation resulted in a total annual family income of 5105 pesos for the household with a smaller land allocation (Dry Temporal Model Option 3.75), and in a land allocation of 1 hectare for corn production, 1.35 for beans, and 1.4 for small grains. This coincides with actual production methods which are more intensive in their inclusion of small grains than their irrigated and moist temporal counterparts. The more labor intensive production methods are preferred, and all production utilizes animal power for land preparation, and employs organic fertilizer rather than inorganic. The family income is strongly supplemented by off farm wages from male labor, of which 2.85 units are applied to this sector.

The pre-NAFTA evaluation of dry temporal model with the larger plot endowment (Option 5.75) exhibited some interesting differences in its initial state. As expected, family income was significantly higher, at 7566 pesos annually. In addition, the land distribution among crop varied distinctly. Grains were produced on 2.75 hectares with organic fertilizer, as was corn on 1 hectare. Beans, however, were produced on two hectares. This is a significant change from the dry temporal model option 3.75. In addition, the household did not rely on male off-farm labor as extensively as in the smaller model (Option 3.75), with only 2.45 units applied to this activity.

The evaluation of NAFTA induced impacts on the rural household began with the inclusion of the industrial labor allocation option for female household youths. As in the

previous models, the existing size of the female workload limited the allocation of this activity to .13 of one full time allocation. This small change, however, was sufficient to result in significant changes in the total annual household income in both options. In the small land endowment option (Option 3.75), this new allocation of female labor to off-farm sources resulted in a change in income from an initial 5105 pesos annually to 6236 pesos annually, or an increase of 22%. In the large land endowment option (Option 5.75), this new labor allocation alternative resulted in an increase in total annual family income from a previous 7566 pesos to 8697 pesos, or an increase of 15%. In this option (5.75), the allocation of female labor to the industrial sector also changed the overall production strategy of the rural household.

Price changes were also evaluated in the two options of the dry temporal model. As both land endowment options of the dry temporal model were initially producers of small grains for the formal market, any NAFTA induced price drops in these commodities proved detrimental to overall family income. In the small land endowment option (Option 3.75), reductions of small grains prices of 15, 35, and 50 percent resulted in significant financial losses as income fell from an original 6236 pesos annually to 5630, 4820, and 4293 pesos respectively. In addition, the largest price drop evaluated (50%) resulted in a change in production strategy which included a shift in all lands previously dedicated to small grains. These lands were rededicated to bean production. In the large land endowment option (Option 5.75), losses in the value of small grains of 15, 35, and 50 percent resulted in reductions in family income from an original 8697 to 7422, 5722, and 4606 pesos respectively. This option also demonstrated a shift in production patterns with a 50% decline in small grain prices which resulted in the

abandonment of small grain production in favor of beans. The loss in small grains price was actually more detrimental to the large land endowed household, who lost both a larger quantity of income and a larger percentage of their income (47% for Option 5.75 versus 31% for Option 3.75) as a result of a large fall in small grain prices. However, this household's initial total income was much higher, resulting in a ability to sustain greater losses relative to the small land endowment household.

While a fall in small grain prices resulted in deep financial damages to the dry temporal household, regardless of their land endowment, a fall in corn prices resulted in an opposite effect. This was expected due to the fact that these producers are not providing production for the formal market, and despite their production activities, are truly consumers of this product. In the small land endowment household (Option 3.75) reductions in the price of corn of 15%, 35%, and 50% resulted in increases of family income from 4293 to 4818, 5518, and 6043 pesos annually respectively with no corresponding changes in production strategy. When evaluated together, the corresponding drops in both corn and small grains prices do cause an overall reduction in total family income, however, this reduction is minimal as the price drops nearly offset one another. At the maximum price drop of 50%, income is only reduced to 6043, or 193 pesos lower than its original total with unchanged prices. This scenario is still significantly greater than the total family income of 5103 before both NAFTA induced price changes and changes in availability of industrial employment, indicating that the NAFTA induced changes have significantly benefited the financial status of the dry temporal household with a small land endowment.

A fall in corn prices had similar effects on the large land endowment household (Option 5.75). Losses in value for corn of 15%, 35%, and 50% resulted in increases in family income from 4606 to 5131, 5831, and 6356 pesos annually respectively. While these increases did help make up for the loss of income from falling small grains prices, the total effect was much more detrimental for the large land endowment household than it had been for the small land endowment. This occurs as a result of the fact that the household consumption requirements (corn) are constant across the two models, resulting in equal gins from falling corn prices. However, the large land endowment option has the ability to produce a much larger quantity of small grains for sale on the formal market, resulting in much greater absolute losses when the price of small grains falls. Due to this discrepancy between the size of the gain and the size of the loss associated with simultaneous falls in the prices of small grains and corn, the NAFTA associated price drops in these commodities resulted in a much greater total loss in family income. With a 50% decline in both small grain and corn prices, family income falls by 2341 pesos, from an initial 8697 (before price changes, after NAFTA induced labor alternatives) to 6356 pesos annually. In this case, this final value is significantly lower than the pre-NAFTA annual income of 7566. In order for this household to maintain its pre-NAFTA income levels, the price of small grains could not drop greater than 15%.

For the dry temporal household, other price changes were irrelevant with the exception of beans. As the directional shift of any NAFTA induced price changes in the price of beans was uncertain (if indeed any exist) the household models were evaluated with both small increases and decreases in these prices. In the small land endowment household model (Option 3.75) a 10% increase in the price of beans was not sufficient to

alter the households production strategy, yet it did increase family income from 6043 pesos annually to 6634. A 10% decrease, however, not only dropped income from 6043 to 5707 pesos annually, but also triggered a shift in production away from bean production towards the production of small grains, even under extensive losses (up to 50%) in the value of small grains prices, indicating that the household is much more sensitive to changes in bean prices than those of small grains with respect to their production strategy.

The large land endowment household model (Option 5.75) also responded with an increase in family income with an increase in bean value (a 10% increase resulted in an increase from 6356 to 7427) with no associated changes in production. The evaluated 10% fall in bean prices, similarly mirrored the response of the small land endowment household with income falling (from 6356 to 5802 pesos) and production shifting from a bean intensive pattern to a system heavy in small grains even under heavy losses in small grain value.

9.3.4 Implications of Female Workload

In all estimations across all resource endowments and price/labor structures, the available quantity of female labor was a binding constraint. The available quantity of female labor was explicitly restricted to 175 work hours monthly per female, with two female members per household. While land and male labor were also binding constraints, the model exhibited certain results distinct from the actual characteristics of this sector which were directly tied to the binding nature of female labor. Every resource endowment model, under every labor/price structure, limited the application of female

labor to the industrial sector to .13 of a full time worker. As the only options actually available are 0 and 1, it is surprising that many households choose to apply a full unit to this activity. In addition, in all household models, one hectare of land was dedicated to the production of corn. This activity is highly intensive in its utilization of female labor in the food processing stage in late fall (shucking, seed selection, degraining, drying, etc . . .), a time period which coincided with the majority of the binding constraints of female labor. This activity was also preformed at a greatly reduced consistency in the model versus in the actual communities. For these reasons it was hypothesized that the binding nature of female labor in these circumstances was perhaps unrealistic, and causing anomalies in the model predictions.

To evaluate this situation, the labor availability of each female was increased from its previous 8.75 hours daily (5 days per week), to an average of 10 hours daily (7 days a week) which could be allocated as the model saw fit. As the available quantity of female labor was increased the amount dedicated to the industrial sector was increased accordingly, while the abnormally small amount of corn activity was left unchanged. Across all four models (Irrigated, Moist Temporal, and Dry Temporals 3.75 and 5.75) this increase in female workload capacity resulted in an increase of industrial allocation of female labor from an original .13 to 1.33.

As increase in female workload capacity left corn production unaltered, it appears that this limited quantity of resources applied to this activity is attributable to other limiting resources distinct from female labor. While this unrealistic resource allocation chosen by the model was not altered by the increase in female workload capacity, the allocation to the industrial sector was brought up to levels more congruent with

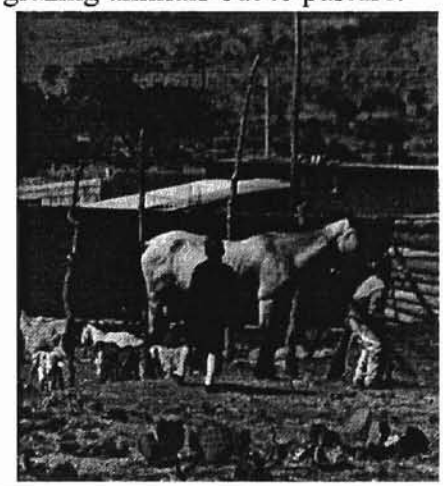
observations in the sector. This indicates that the allocation of youth female labor to the industrial sector does not generally occur as part of a reallocation of female work load (as none of the original model exhibited this under any of the price structures evaluated), but rather as an augmentation to the existing female workload. This is a highly significant factor in the evaluation of the sustainability of the rural community in the face of NAFTA. While this labor option, when utilized fully, has the capabilities to greatly augment the family income and thereby improve some aspects of quality of life, the costs of these improvements are borne disproportionately by the female gender and by family youths. In addition, it was expected that this heavy exposure to the industrial sector, apart from increasing workloads and changing family incomes, could have other implications for the sustainability of the rural community by altering the cultural/economic context in which these youths are making their allocative decisions.. Concerns were present that these changing patterns of labor allocation among the industrial/agricultural sectors could result in an eventual degradation in the viability of the rural community, despite the initial boost to rural incomes, due to intersectoral labor transfers away from agricultural and the rural sector. This possibility was evaluated further in the interview section of the qualitative results chapter as an evaluation of migration alternatives as seen by local youths.

9.3.5 Model Limitations

While the model was capable evaluating the rural family production strategy response under various policy and resource endowment changes, there did exist certain variables vital to this decision making process which were not included due to difficulties in measurement and other issues which the model was unable to evaluate. As these variables have the potential to alter the actual outcome, they are briefly addressed in this section. These variables excluded from the model principally consisted of long distance migration patterns and child labor allocations. Migration patterns can occur either as a result of economic stress, tying it directly to the profit-maximizing results of the model, or as a result of long-run result of changing cultural values and life-styles, which do not bind the younger generations to the rural sector as strongly as previous generations. These factors have significant implications for the sustainability of the rural sector, yet are not evaluated within the model. They are discussed in more detail in the social results section.

Image XIV: Young boy planting corn.

Image XV: Children taking grazing animals out to pasture.



The second factor which was neglected in

the model was that of child labor. While labor requirements are separated by age and gender, and the model is evaluated across families with varying resource bases, children remain a relatively large social group left unexamined in this study. Due to the complete exclusion of child labor, any negative effects on this population group will not be exhibited in the model. Child labor is vital in the rural production system, as illustrated in the attached images which examine the child's role in production in the Mexican agricultural system. Image I shows a young boy assisting with the planting of the corn, while Image II shows two children taking the household animals (sheep, goats, horse and cows) out to graze after school. Image III includes a small boy accompanying a woman from the fields in the collection of firewood, and IV shows a young man caring for a large sheep and goat herd (an observation which was taken in school hours, indicating that this activity is replacing potential education activities). Interviews confirmed that children do play an important role in the families production strategy. In difficult times, children will be taken out of school to work. Their labor is generally applied to planting and weeding activities in the field, assistance in the care of small agricultural animals (chickens, rabbits, pigs and turkeys) in the patio setting, herding of animals needing grazing, and

Image XVI: Child accompanying grandmother home from the mountain after a morning spent collecting firewood.

Image XVII: Boy caring for household rabbits.

collection of firewood. While the model did not specifically evaluate child labor, and therefore does not include any adverse effects on children, it must be assumed that any adverse effects on the family unit will also be transferred to the children. As families reach the threshold of sustainability, the labor resource provided by children will be exploited at an increasing rate. Even when family income and resources are not as scarce, and the family can afford to trade off a portion of total available child labor for school attendance, the child labor provided outside of school hours is a valuable asset to the family unit. The exclusion of this variable from the model is seen to have the potential to alter resource allocation, and more significantly, exclude changes in the child's workload induced by policy changes. In interpreting the final results, this exclusion must be accounted and adjusted for, as must any possible detrimental effects on the children, which could be associated with the NAFTA by way of increased workload and lost education opportunities.

The effects upon children are not the only ones left unapprised within the confines of the linear programming model. In general, the LP results will only confirm expected changes in production strategy and family income. The effect that these changes may have upon the household and community are left ignored. To help overcome this

shortcoming, this study implemented a social evaluation consisting of interviews and surveys to help evaluate the NAFTA induced changes from more than one perspective. The combination of these two methods allows for a holistic approach that takes into account monetary, production, and social aspects of the community's adjustment to NAFTA.

9.4 Qualitative Evaluation

The social evaluation was based on the results of survey data, visual evaluations, and interview material. The subjects covered in this section evaluated community structure, economic activity, and producer opinions on how changing industrial/agricultural interactions have affected their lives. This section has an advantage over a pure LP evaluation in that it includes actual opinions from community members with respect to the changing situations. These are impacts which cannot be evaluated by traditional economic means.

Detailed interviews were conducted at all levels within the community to evaluated resident opinion with respect to the industrial corridor, problems in the agricultural sector, social changes, and gender issues. These interviews revealed many aspects of industrialization and globalization which could not be devaluated within the confines of the linear programming model. These interviews are separated into three distinct sections for evaluation, including:

A) Campesino interviews: evaluating agricultural sector and production concerns.

B) Youth interviews: evaluating issues such as emigration and education.

C) Female interviews: evaluating gender roles within the household, economy, and community.

9.4.1 Campesino Interviews

These interviews provided most of the detailed labor allocation data with respect to crop activities. Timing of soil preparation, fertilization, planting, weeding, tilling, harvesting, and food processing were all evaluated and are summarized in the attached calendar (Appendix IV). In addition to the timing of production activities, the associated labor requirements were also discussed in detail for the construction of the enterprise budget. While labor requirements by activity have been somewhat aggregated in the budget, the dissaggregated data is available in the appendix 'Notes from Producer Interviews' (Appendix V). This is not a transcript, but rather a summarization of all applicable data collected with respect to crop production and labor requirements. The data was summarized from interviews that took place over a 6-month period with various producers. Whenever possible, the data was verified across producers for accuracy.

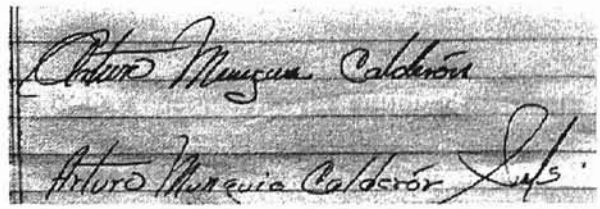
Apart from the technical nature of production, many of the campesino interviews covered agricultural topics of concern to the individual producers. The agricultural aspect stressed most often in these interviews were concerns over the 'temporal' or rain fed nature of their lands. Due to lack of irrigation, a season of late rains can completely negate the possibility of a harvest, as it pushes the growing season to late into the year, and frost destroys the crops. In years in which the crops are destroyed, or are not sufficient to meet the family consumption requirements, they indicated that younger

family members seek work in the talleres or industrial corridor to help cover the costs of the lost crop and to purchase replacement commodities for family consumption. Older males may seek work outside of the industrial sector as 'abañiles', or laborers.

While the majority of the campesinos have less than an elementary level education, they are very interested in improving their lands, and have expressed interest in advanced topics such as soil chemistry and hydrology in their attempts to understand the production process and how yields are affected. Many producers are very proud of the education which they have, and are quick to distinguish each year of elementary education which they received. Those with only a 4th grade education will often defer to one with a 6th grade education in conversations regarding matters of the world, indicating the respect that those addition two years of education earn. The following figure is a writing sample, which a producer insisted on providing during an interview to prove that he knew how to read and write.

Despite the emphasis these producers place on continued education and their strong desires for improvement, as long as they are functioning under the current resource shortages with respect to extension services, and credit for land improvements, the agricultural systems in this area do not appear to have much hope for improvement. However, it appears that the producer base is open and interested in the application of new technology and production methods if they were to come available. In the meantime, it appears that yields will most likely remain low, and income will remain at a barely subsistence level.

Image XVIII: Writing sample provided in producer interview.



With these difficulties abounding, one of the issues at the heart of many producer interviews was the sustainability of the rural community. It was felt that emigration to rural areas would be an inevitable result of the pressures such as hunger, lack of health services, and the extensive poverty which predominates in the rural areas. It was indicated that this type of immigration was not common among older residents due to lack of opportunities in urban areas. This reduced demand for mature labor in urban areas, combined with a prevalent resignation to rural struggles and poverty, resulted in a maintenance of the agricultural allocation of mature labor.

This resignation was apparent in almost all of the producer interviews. In some, it was a direct resignation to the difficulties of rural life, as in the case of the man who summarized this feeling when he stated simply -- "Sabemos aguantar." In other interviews, it was expressed rather as an imposed role restriction which prohibited alternatives. The gentleman who stated, "I am campesino. It is what I know", spoke for many producers who did not pursue off-farm employment due to a deep resignation and commitment to the rural sector which not only maintained them, but defined them.

9.4.2 Youth Interviews

These factors, however, did not apply as homogeneously to the younger members of the community. While many of the older members claimed that their role within rural sector was based on personal ties and commitments, they admitted that the younger generation was kept within the community solely by the nearby existence of the industrial corridor. Without this resource, it was noted that many of the younger peoples would leave the community searching for urban employment. Interviews with younger

members of the community tended to support this observation. In general, it appeared that young males were much more interested in leaving the communities than young women.

Rural-urban migration, while probably reduced by the existence of the corridor, was still common, with many families expressing that young men were currently missing from the household while working in Apizaco, Tlaxcala, or Puebla. In addition, international migration was also prevalent, with almost every young male interviewed either 1) expressing interest in possibly migrating someday, 2) commenting on a friend who had worked or who was currently working in the United States, or 3) indicating that they had previously worked in the United States as migrant labor. Many young men in the age range from 20 – 27 had either previously worked in the United States, or received employment offers. The majority of these opportunities were as agricultural labor in either Virginia or North Carolina. Almost without fail, young males listed international emigration as the most desirable manner in which to improve their quality of lives, housing situation, and agricultural plots. Higher education was seen as unrealistic, and national off-farm labor was often viewed as a substitute, rather than a compliment to the agricultural sector.

While this high attraction to immigration appears at first to threaten the sustainability of the rural communities, it must be noted that the majority of youths interviewed expressed a desire for off-farm employment and/or immigration as a means to improve the viability of their situation in the campo. Many desired a good paying job so that they could save up their money and better their homes or plots. One young woman noted that with the money she had saved from her job, she had saved enough to

add a bathroom to her parents' home. Another young man was preparing to accept a migrant labor position in North Carolina and planned to use the money to add two bedrooms to his family's one room home. Of all the interviews, never once was it expressed that they desired to move away from the rural sector permanently. In this aspect, we can see that the same commitment to the agricultural sector which was seen so strongly in the older population is also present in the younger generation, it is only expressed differently. While this commitment may stem from distinct causes (in general from family ties rather than role restrictions), it continues contributing to the sustainability of the rural community.

9.4.3 Female Interviews

Many women, of all ages and walks of life, were interviewed. These women provided the majority of the data on gender division of labor, including female activities in agriculture, processes of patio agriculture, and data on domestic activities. Most women indicated that they are fully involved with most of the agricultural processes of planting, weeding, harvesting and processing (appendix V). A few select activities were preserved solely for males, such as preparing the land with the mules (as they were said to be 'to stubborn' for a woman to work with them) and the harvesting of frijol and haba due to the nature of the plants.

In addition to their direct assistance in the fields, women are also the sole source of labor for the domestic sector, which is extensive in its requirements. In addition to cooking and cleaning, the woman is often the sole provider of labor for domestic or patio agricultural activities including small animals, herbs, fruit trees, and vegetables. In addition she is also responsible for wood collection and chopping, and any collection of wild fruits or herbs to be used for family consumption.

Image XIX: Patio in Zapata with woman chopping wood.

Apart from the agricultural and domestic sectors, female labor is also in high demand in the industrial sector. In interviews with the young women working in the local clothing industry, many of these women indicated that they were not yet married, and still resided with their parents in the local villages. While many young women do commute to the industrial corridor, local options are preferred when available. As one young woman stated, the local workshops "are nice because you don't have to go all the way to Xicohténcatl if you want to work and have a little bit of money."

While the principle aim of these interviews was to evaluate the gender distribution of labor, the extent of domestic activities, and their unique interaction with the industrial sector, other issues often entered into consideration. Issues such as a woman's role in the

family, and family planning often exhibited large differences across generations, and appeared to be influenced by an 'opening up' of the small villages which currently have much more exposure to the outside world than before. One woman recounted the first time anyone came to tell them that they had a choice in how many children they should have, and that they needn't have anymore than they wanted. It was a group of Canadians who came in the mid-60's. At the time she had five children – now she has twelve. She stated that the message did not mean a lot to her. Her daughters however, express a strong interest in available 'metodos.' They are intrigued by the size of U.S. families, and claim that "American methods must work better than ours".

This large intergenerational difference in attitudes towards issues regarding a woman's role in the family and community reflects the deep impact of the communities opening up to the outside world. As industry, jobs, and outsiders expand into the previously isolated areas, the results go much deeper than pure economic activity.

10. CONCLUSION

The general objective of this study was to increase knowledge over the impact of the North American Free Trade Agreement on the interaction between the agricultural and industrial sectors on the regional and household levels. The specific objective was to determine the economic and social impact of the North American Free Trade Agreement on rural individuals and communities in the Xicohténcatl industrial corridor region of Tlaxcala, Mexico. As this is one the first major trade agreements between nations of such differing cultural and economic backgrounds, and due to its unique inclusion of the agricultural sector, this agreement is seen to have an extensive potential impact on the rural communities of all three participatory nations. The rural Mexican communities were seen as particularly vulnerable due to their relatively low income levels, and increased incidence of producers whose basic needs are only marginally met.

The impacts of NAFTA among the rural communities included in this analysis were evaluated by way of a three stage study. These stages were derived from the assumptions that the principal economic manners in which NAFTA has impacted these rural communities have been through price impacts in agricultural communities, and changes in industrial demand for labor and that these changes have resulted in a distinct and measurable change in the rural family's production strategy. Based on these assumptions, this study attempted to evaluate these changes in a stages which progressively examined the depth of these impacts.

The first stage of the study included an evaluation of probable commodity price impacts, and changes in the industrial demand for labor. This process was conducted

through simple graphical analysis of trade and price data due to the limited scope of the study. This process revealed that NAFTA is most likely associated with falling prices in corn and basic grains, while it is likely to provide upwards pressures on vegetable prices. This indicates a high probability that it will be resource poor producers, without access to irrigation or humid lands, which will be disproportionately damaged by NAFTA induced price changes. With respect to the industrial sector, interviews and data evaluations indicated that in this region NAFTA has not only been associated with strong industrial growth, and increases in industrial demand for labor, but also that the industries established under NAFTA's influence tend to have greater capital backing (resulting in a more stable industrial sector and more extensive labor demand).

The second stage of the study included the creation of a linear programming model for the evaluation of household response to the various NAFTA induced changes in prices and labor demand. This model utilized labor resources separated by age and gender to evaluate the impacts across different members of the household. The model developed for this study was unique in its inclusion of unpaid female labor activities (such as household management, child-raising, food-preparation and collection) as a restraint within the activity column. This forced the women's contribution to be included in the final outcome, despite the lack of monetary value. This avoided the devaluation of unpaid labor which typically occurs in this type of model, and provided an important first step to accurately evaluating the policy impacts of NAFTA upon the entire household and community, not just those whose labor is compensated monetarily. By including the often overlooked unpaid labor sector (which is normally preformed by women, elderly, children, and absolute poor), this population sector received equal weight in the

evaluation. This type of approach, if more widely implemented, could result in more equitable policy evaluations that ceased to devalue these indispensable contributions.

The model also allowed for variations in resource endowments to view how the NAFTA impacts varied across communities of different resource bases. These varied resource endowments allowed for the grouping of households and communities by production system. The principal types of production systems evaluated by the model and their summarized results are listed in the following table (Table XII). This model

Table IX: Results classified by production systems.

Grouping	*Activities*		*NAFTA effect*
1) Irrigated	* Vegetables sold	--	Price increase raises income
	* Net grains purchaser	--	Price drop reduces expenses
	* Industrial sector labor	--	Changes income little
2) Moist Temporal	* Potatoes sold	--	Price effect uncertain
	* Net grains purchaser	--	Price drop reduces expenses
	* Industrial sector labor	--	Income offsets any price losses
3) Dry Temporal (large land endowment)	* Grains sold on market	--	Price drop reduces income
	* Industrial sector labor	--	Income offsets less than 15% of loss from price drop
4) Dry Temporal (small land endowment)	* Net grain purchaser	--	Price drop reduces expenses
	* Industrial sector labor	--	Income offsets any price losses

indicated that NAFTA impacts have been inequitable in their distributions among small farmers with varying resource bases. Those producers with irrigation resources tended to suffer smaller increases in the female workload from the expanding industrial sector, benefit more from falling corn and grain prices as they tended to be net purchasers of

these products, and benefit from rising fruit and vegetable prices as these commodities were more suited to the higher water availability of the irrigated lands. These producers were also those with the highest income levels before NAFTA, with incomes over ten times that of many producers with less natural resource endowments.

Producers on non-irrigated (temporal) lands with high rainfall, and on small parcels of dry temporal lands were not as strongly assisted by the price changes assumed to be associated with NAFTA, however, falling corn prices helped them (as they did all family models considered in this study) as they were net purchasers of this necessary commodity. In addition, the additional off-farm income provided by the expanding industrial sector more than offset any losses incurred from price drops in the few commodities which were produced for sale on the formal market.

Of the remaining producers, those on dry temporal land parcels with large land endowments were suffered the strongest negative effects. This arose from the fact that they were marginally participating in the market due to the large size of their parcels, but the most appropriate commodities for production on their lands were corn and small grains. These were the commodities with the strongest theoretical relationship with a NAFTA induced price decline. Due to this drastic loss of income caused by a decline in small grain prices, the increased demand for industrial labor only provided sufficient supplementary family income to offset small grain price drops of less than 15%.

These results indicate that the economic impact of NAFTA on the rural producer will vary widely based on location and resource availability. In addition, this variation is not without bias, and while the absolute poorest producers were not necessarily those effected most adversely, those who were damaged were only slightly better off, and could

ill-afford such losses. On the other hand, those producers who benefited the most were those with extensive resource bases whose initial pre-NAFTA income was far above that level of other producers.

While the distribution of NAFTA associated benefits was decidedly skewed, it is vital to note that in the majority of cases, overall family income was significantly improved. This was generally a result of the allocation of female labor to the newly expanding industrial sector. This new allocation pattern presents a variety of significances to the rural community. While family income is increased, female workload is also altered, along with traditional gender roles and family structures.

Despite these alterations in the traditional social fabric of the community, occasioned by changing resource allocation, increased exposure of household youths to the off-farm industrial sector, and an increased opening up of the community as a whole, it is concluded by this study that the NAFTA induced changes have improved the overall viability of the rural community in this industrial zone. By increasing family income, and reducing the overall dependence on agricultural production, the NAFTA induced industrial expansion has reduced both the risk (associated with climactic, ecological, and economic crisis) and vulnerability of the rural household. However, it must be emphasized that this improvement in sustainability is not without cost. It is won at the expense of many people, household youths whose workload allocation is altered, rural women whose workload is augmented, and campesinos whose labor is devalued.

These changes offer new pitfalls to the rural community such as potentially altering the long-term labor allocations to the agricultural sector and increasing the incidence of rural/urban migration, and compromising the integrity of the family unit by

drastically altering traditional gender roles. However, based on the social evaluation it is concluded that these effects will most likely remain minimal in the short run, and over time will likely result in a gradual shift in the structure of the rural community that remains congruent with its sustainability. All members of the rural communities under study which participated in the in-depth interview stage of this study expressed a deep commitment to the rural sector which appeared unlikely to be eroded by the increased outside influences of the industrial sector. This was expressed in both words and actions, as many study participants had taken their off-farm industrial earnings and re-invested them within the rural communities to which they belonged.

It is on the basis of these results and observations that this study concludes that the effects assumed to be associated with the North American Free Trade Agreement (namely an increase in industrialization within Mexico, and various shifts in agricultural commodity prices) are congruent with the sustainability of the rural community at both an economic and cultural level. While some cultural changes are to be experienced, and the results are not uniform across households of varying resource bases, they are accompanied by a reduced exposure of the rural household to many of the traditional climactic and economic risks associated with agricultural production.

These are important considerations in both Mexico's continued development and that of other nations following similar paths. The benefits provided to these rural communities has occurred only as a result of the rural location of this industrial corridor. When industrial growth occurs in purely urban settings or conglomerates in only one or two specific areas of a nation, the ability of rural communities to utilize this resource to their benefit is eliminated. The absence of this resource, coupled with the agricultural

price declines associated commonly associated with the economic restructuring process can place significant pressures upon the rural community. Policies which encourage a more even industrial development can simultaneously support the process of industrialization while providing essential support to the especially vulnerable rural sector.

This support is an urgent necessity throughout the world. A 1993 study by the Food and Agricultural Organization of the UN used a cross-sectional analysis to evaluate rural poverty over 37 nations. It was found that the majority of the world's poor are located in rural areas, with concentrations in area which are high-population or resource-scarce, such as that evaluated within this study. With so much of the worlds poverty stricken residing in rural areas, it is necessary that the interactions between the agricultural and industrial sectors be fully understood so that policy makers can utilize and exploit these relations, therefore accomplishing the broadest improvement in basic welfare possible with their given set of resources.

This study shows that the agricultural and industrial sectors are not incompatible, and that in the given setting they are indeed complementary. These results are expected to vary from one location to another, for as the study shows, various land and resource endowments have the ability to greatly effect the outcome. However, the potential of this relationship appears to have great significances for both rural and national development policies.

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Appendix I:

CUESTIONARIO GENERAL: Zapata, Cárdenas, Capula, Zotoluca, Santa Fé La Troje.

Nombre de Familia:_____

Cuantos personas viven en su casa:_____

Edad y genero de estas personas:_____

Empleo de estas personas:_____

Cuanto kilos de maíz usa su familia cada semana:_____

Cuantos kilos de frijol? de verduras? de carne?:_____

Tienen terreno que cultivan:_____

Cuantos hectáreas tienen:_____

Es de riego o temporal:_____

En que esta sembrado:_____

Cuantos hectáreas se siembran con cada cultivo:_____

Cuantos kilos rinde este terreno al tiempo de la cosecha:_____

De esta cosecha, cuanto se vende y cuanto queda para el uso de la familia:_____

_____

Appendix II:

FABRICA 'LINDA VISTA'

CIUDAD INDUSTRIAL DE XICOHTÉNCATL

Objetivo: información general sobre los empleados del fabrica con enfoque de genero.

B -- Sabe usted cuantos personas trabajan aquí?

I -- Claro, dos mil seiscientas.

B -- Cuantas de estas personas son mujeres?

I -- A ver – todo el dato, exactamente. Todo el dato exactamente, es muy rápido. Mira, tenemos .. mujeres tenemos mil cuatrocientos ochenta y dos.

B -- Y cual es la edad promedio?

I -- El edad promedios que tenemos es de veinte dos a veinte cuatro años.

B -- Son muy jóvenes no?

B -- Y todos estos trabajadores llegan de las comunidades cerca de aquí?

I -- Apizaco, Huamantla.

B -- No hay personas que llegan de mas lejos?

I -- No, todos son de aquí de estos localidades. El veinte tres por ciento vienen de Apizaco, el trece por ciento, o catorce por ciento vienen de Tetla. El dieciocho por ciento vienen de Xalostoc. Son los lugares mas representativos. Y el nueve o diez por ciento de Huamantla.

B -- Y que es el salario promedio de los trabajadores?

I -- Trienta cinco setenta y cinco

B -- Y cuales son los horas de trabajar aqui?

I -- Ocho horas diarias. Pues nos vamos a hacer un corrección. Son nueve punto uno horas, de lunes a viernes. Lo que pasa es que cubren el tiempo de sábado. Ahorita la gente que están laborando están trabajando tiempo extra.

B -- Pues, de sus datos de los empleados, hay algo otro que tiene significado?

I -- El estado civil, el veinticuatro por ciento esta casado, el sesentiuno por ciento soltero, y a lo mas están divorciado, o viven en unión libre. Tenemos un seis por cientos de madres solteras, creo que esto es muy representativo.

B -- Mas que la mitad son mujeres que trabajan aquí. Las estadísticas sobre los hombres están diferentes que las de las mujeres?

I –No, son iguales, todos están iguales.

B -- Mas o menos este gente que están trabajando con ustedes, cuanto trabajan en otros cosas aparte de ir al fabrica, dedican a otros cosas?

I -- No, ninguno

B -- Regularmente en donde se incluyen la mujer, en que proceso de trabajo?

I -- Pues esto es un industria maquillador y están en el proceso el cien por ciento.

B -- En la cosura? En este caso tiene usted supervisores horaria . . .

I -- Si, claro. Desde luego.

B -- Y estas supervisores son hombres o mujeres?

I -- Predomina los hombres, en la cuestión de supervisión. Si, el proceso productivo en si es este realmente por las mujeres. Ya . . . es cosura básicamente, y ya en la cuestión de supervisión predominan los hombres. Aunque tenemos realmente mujeres. Tenemos una gerenta por ejemplo, pero de todos los gerentes tenemos una mujer nada mas. Y de los supervisores tenemos una mujer igual, ya de son ingenieros de métodos, ya hay mas mujeres. Estamos hablando de .. . de los treinta y dos ingenieros que tenemos, estamos hablando de ocho mujeres, por ejemplo.

B -- Y en el proceso de cosura no tienen hombres?

I -- Si, lo que prodima es la mujer. Para que me entiende un poquito mas claro, de los dos mil seiscientos que les dije, dos mil son opérales, para que me entiende, o obreros. De estos dos mil obreros los mil cuatro cientos son mujeres. Y el resto puramente son varones. . . . Otra pregunta?

B -- Pues, también no se si podría decirme como el TLC ha afectado a este fabrica? Yo no se si exporta mucho . . .

I -- Todo el producción de este fabrica es de exportación. El cien por ciento que se fabrica . . .

B -- A donde lo llevan?

I -- Estados Unidos, es una maquilladora. Nosotros lo que hacemos es exporta el trabajo.

B -- Por esto después del TLC la cantidad de producción ha aumentado o es el mismo que antes?

I -- No, se queda el producción. Si me entiendo, repito el cien por ciento. Solo aumente los facilidades de todos parámetros aduanales de exportación y importación se han simplificado.

B -- Pero no sabe usted si la cantidad del producción ha cambiado?

I -- No. No tengo estos datos.

Appendix III:

ENTREVISTA:

MUNICIPIO DE CAPULA

BECKY MELINDA NELSON	PRESIDENTE MUNICIPAL
Cuantos personas hay aquí en este pueblo?	Aproximadamente somos como mil ochocientos
Mil ochocientos, hay muchos.	Si.
Si, hay muchos no, por un pueblo tan pequeño.	Pues, si es pequeño, es pequeño, pero le ve bien, ya es todo esta parte, y esta parte
Si, no he pasado por este parte.	
Pues, con todos estos personas, hay muchas personas que pasan para trabajar afuera, o que hacen las personas en sus actividades económicas? Hay mucho trabajo aquí en este pueblo?	Pues acá en el pueblo, realmente no hay. Somos nada mas que campesinos. Algunas de nuestras familias están trabajando aquí en el corredor de Xicohténcatl. Algunas de nuestros vecinos son que trabajan allí.
Cuales tipos de servicios tienen aquí en este pueblo? Como tiendas, doctores, cosas así.	Pues es de, . . . tiendas, tenemos algunas. A lo mejor no estamos bien . . . Sobre estos, somos un poco mal. Hablemos de enfermaría, nada mas que tenemos que este centro de salud. Lo que viste al entrada.
Hay un centro de salud	
Hay escuelas aquí? Hay un primaria por aquí, no?	Una aquí, la primaria, y una telesecundaría aquí arriba.
Un secundaria?	Un telesecundaría.
Hay muchas personas que, Pues yo no se, Los jóvenes que quieren ir a prepa,	Si, por supuestamente que si, si quieren ir. Hay algunas que estudiaron en Apizaco.
Apizaco para ir al prepa	Pero nosotros no contamos en esto servicio aquí.

Y de agua para uso doméstico, donde llega este agua en este pueblo

El agua que tenemos ahorita un .... El pueblo que está trabajando para tener un pozo de agua potable por nosotros. Tenemos dos, pero la cosa es que uno esta como reserva porque esto aquí abajo tiene bastante producción por el comunidad.

Por esto, cuando hay problemas con esto, hay un pozo secundario para usar. Hay veces cuando no hay agua para uso domestica, o siempre entre estos dos hay suficiente.

Entre estos dos, supuestamente, le da a todo el comunidad. Si llega a descomponer uno, se echamos en marcha el otro. Siempre tenemos el otro lado

Y hay combis que pasan de aquí al corredor industrial?

Si, aquí hay servicio supuestamente a las seis de la mañana hasta, como, las nueve de la noche.

Si, y pasan regularmente

Constantemente. A la mejor, cada cinco, cada diez minutos. Pero están a la vuelta y vuelta servicios, a la vuelta y vuelta. Si, lo hay.

Y me dijo que hay algunas tiendas, no? Hay suficientes servicios de estos que los personas pueden comprar cada cosa que necesitan aquí, o tienen que salir a los otros pueblos para comprar sus . . ..

Si, como le acabo de decir, en este área no hay . . . A veces si necesitamos algo especial, tenemos que ir a Apizaco a encontrarlo.

Cuán lejos está Apizaco en combi?

Por decir, es ... .veinte minutos.

Veinte minutos, Por esto, es tan cerca que los personas pueden . . .

Si, estamos cerca. . . . a los cosas y servicios que está. Constantemente . . Entonces, sobre esto nada mas que podemos . . .

No hay en este pueblo talleres de coser, o de mecánicos, o otros actividades económicas?

No. Estamos bastante mal porque tenemos . . . en el cuestión de esto, supuestamente, una casa que nosotros le decimos la casa campesina. En alguna ocasión, quieren ver este . . . en esta casa, casa campesina, hacer un taller para algunas señoras que ya no pueden bajan al corredor Xicohténcatl tuvieron trabajo

Appendix IV: Sexual Division of Labor

Lo que sembramos en medio de julio, si Dios quiere que sigue lluviendo y todo eso, cosechamos en el quince de septiembre, o ultimo de septiembre. Ente septiembre y octubre el ote. Y ya el maíz empieza a recoger hasta noviembre. Diciembre y enero a veces es cuando empezamos a desojarlo. Lo desgranamos, y lo curamos con un fertilizante que se llama graneril para que no le entre el gorgojo. Y las macenamos en costales, tenaces, en lo que tengamos. Y va pasando el tiempo y ponemos a hervir con cal para hacer tortillas. De acuerdo a la cantidad que uno quiere poner se pone . . . Hasta ya empieza a hervir, apago lo de nuevo, pero llega cal. Entonces, se dejan friar y ya para mañana se les da una lavita, se lleva al molino, y ya viene el maizita bien rica. Ya para hacer los tortillas. Y se que a mano, porque todavía en el pueblo las hacen a mano y hay personas que las hacen en maquinita. Juntamos a las hijos hacemos si hacemos sopacitos, quesadillas.

Y es las mujeres que cocinan?

Si

Quien siembran, las mujeres o hombres?

Mujeres y hombres. Por ejemplo, nosotros vamos todos a sembrar.

Y aquí todos usan tractor o todavía hay algunas que usan la yunta?

Casi normalmente se usan tractor para barbechar y surcar. Pero para laborear se usa la yunta. Pues, ellos que no tienen tractor usan la yunta desde el principio. Por esto nos acostumbramos a tener los animalitos, las yuntas.

Y cuando trabajan con las yuntas, es los hombres que le hacen?

Bueno, eso, si. Solo usa un hombre. Tiene que ser un hombre. Porque son animales, son caballos enteros, y son estegues, los toros. Entonces, esto no pueden . . . las mujeres no podemos. Pero por ejemplo para allí deshierbar la milpa, el frijol, si vamos mujeres. O de sembrar.

Y de los arboles frutales y los hierbas, quien cuida de estos?

La familia en total. Te das cuenta que luego hay días cuando ando quitando las hierbas. Pues ahorita mi esposo es un poco enfermo, y por esto el no – pero normalmente el trabajo es de los hombres, pero aquí en el pueblo las mujeres, estamos acostumbrada de trabajar.

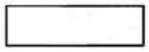
Y de los animalitos?

Todos, mujeres, pues mi esposo, mi hija, hasta Cesar también (*se indica ella a un niño de aproximadamente siete años*). Toda la familia.

Appendix V: Graphical Description of Linear Programming Model

Legend:

Rainfed crop production with organic fertilizer



Rainfed crop production with inorganic fertilizer

Irrigated crop production with organic fertilizer

Irrigated crop production with inorganic fertilizer

Activity Packages (Domestic and Mule)

Off-Farm Labor Allocations

Production Methods Transfers (Fumigations, Fert., etc . . .)

Commodity Purchases and Sales

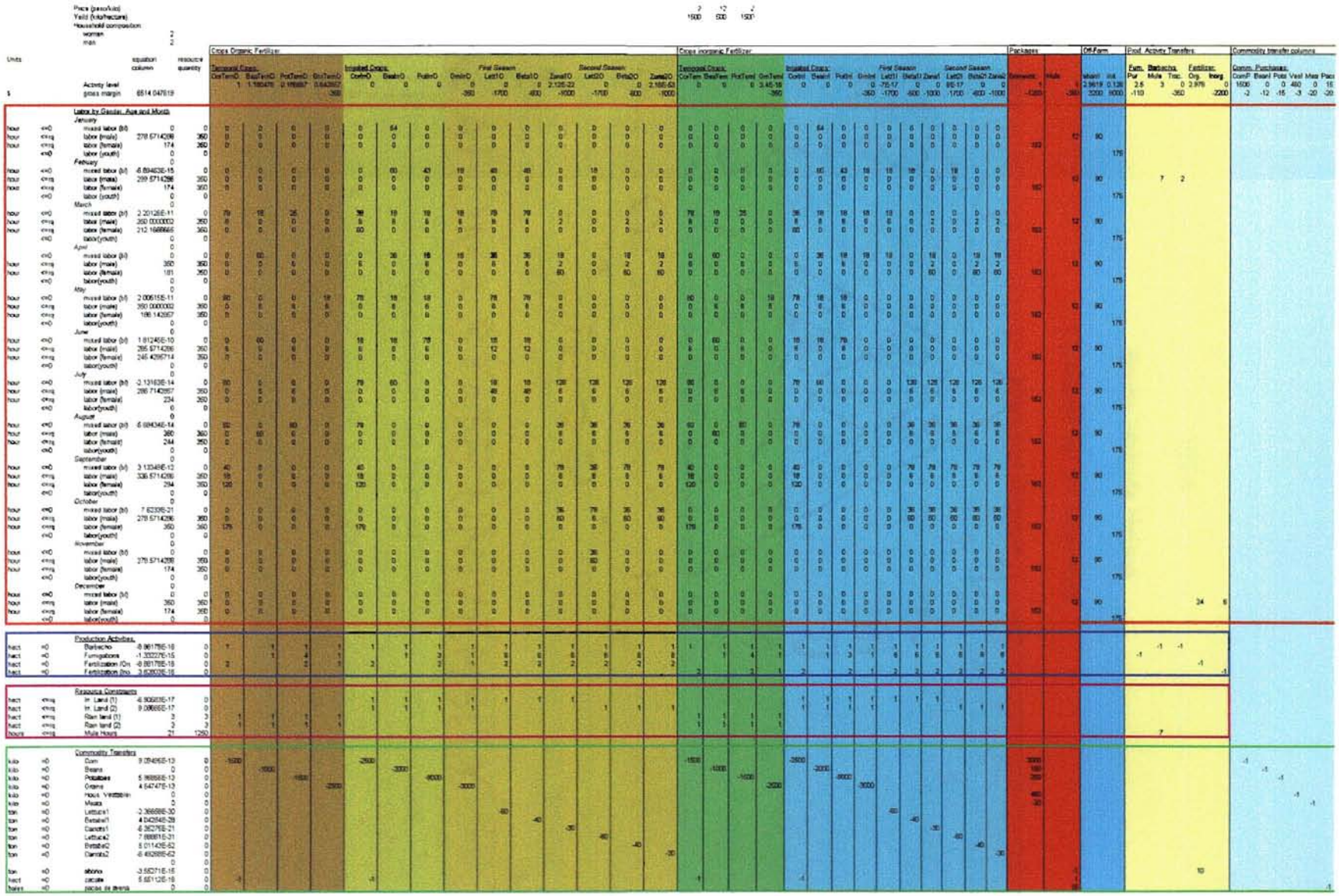
Labor Transfer Columns

Labor Allocation Across Activities

Allocation of Production Methods across activities (Fumig., Fert., etc . . .)

Resource Allocation across activities (land, animal labor)

Transfer of commodities from production activities to final use (sales, domestic, purchases)



Price (pesos/kilo)
Yield (kilo/Hectare)
*Household composition
women 2
men 2

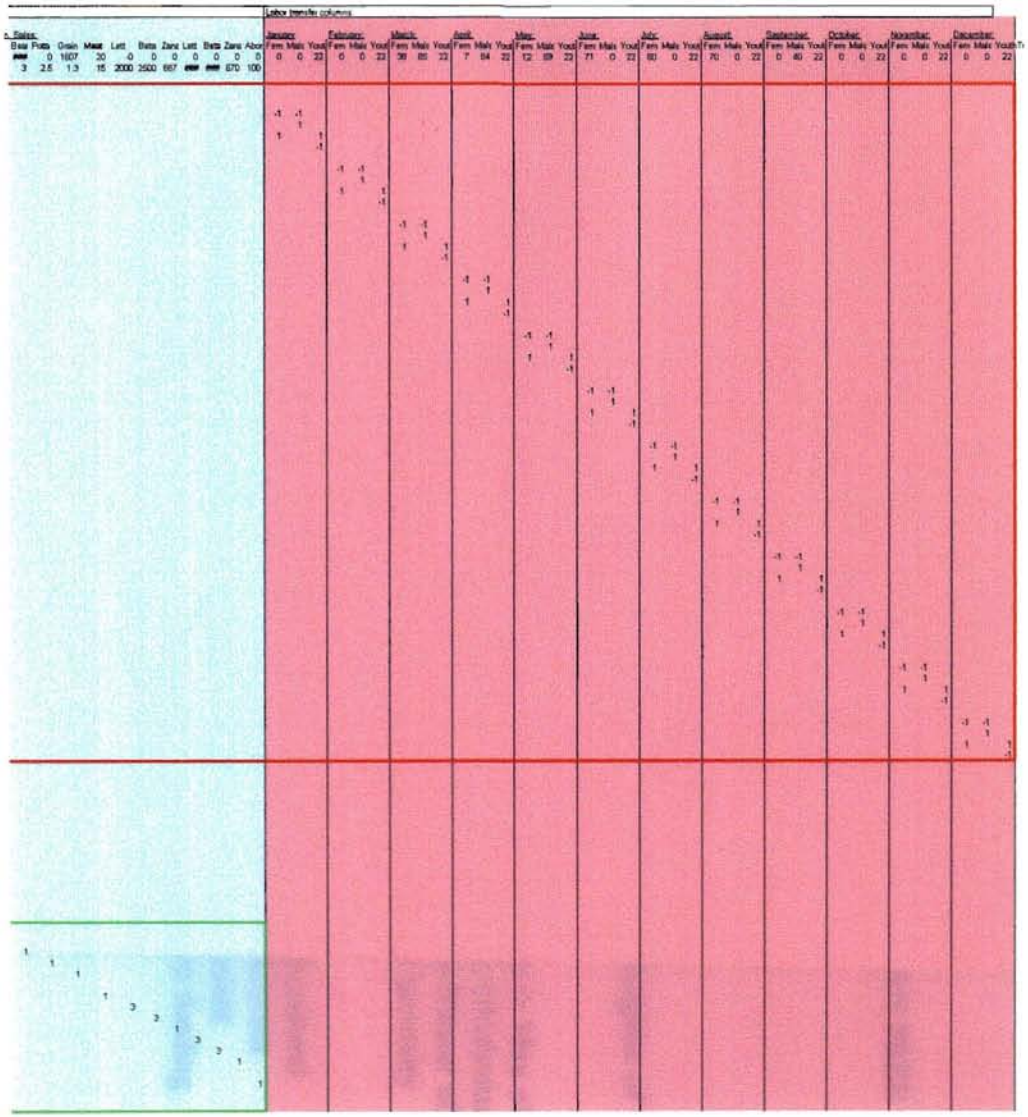
Crops Organic Fertilizer
Crops inorganic Fertilizer
Purchases
Off-Farm
Prod. Activity Transfers
Commodity transfer columns

Units
$
Activity level
gross margin 6514.047619

equation column
resource quantity

Labor by Gender, Age and Month
January
February
March
April
May
June
July
August
September
October
November
December

Production Activities
Resource Constraints
Commodity Transfers



VITA

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